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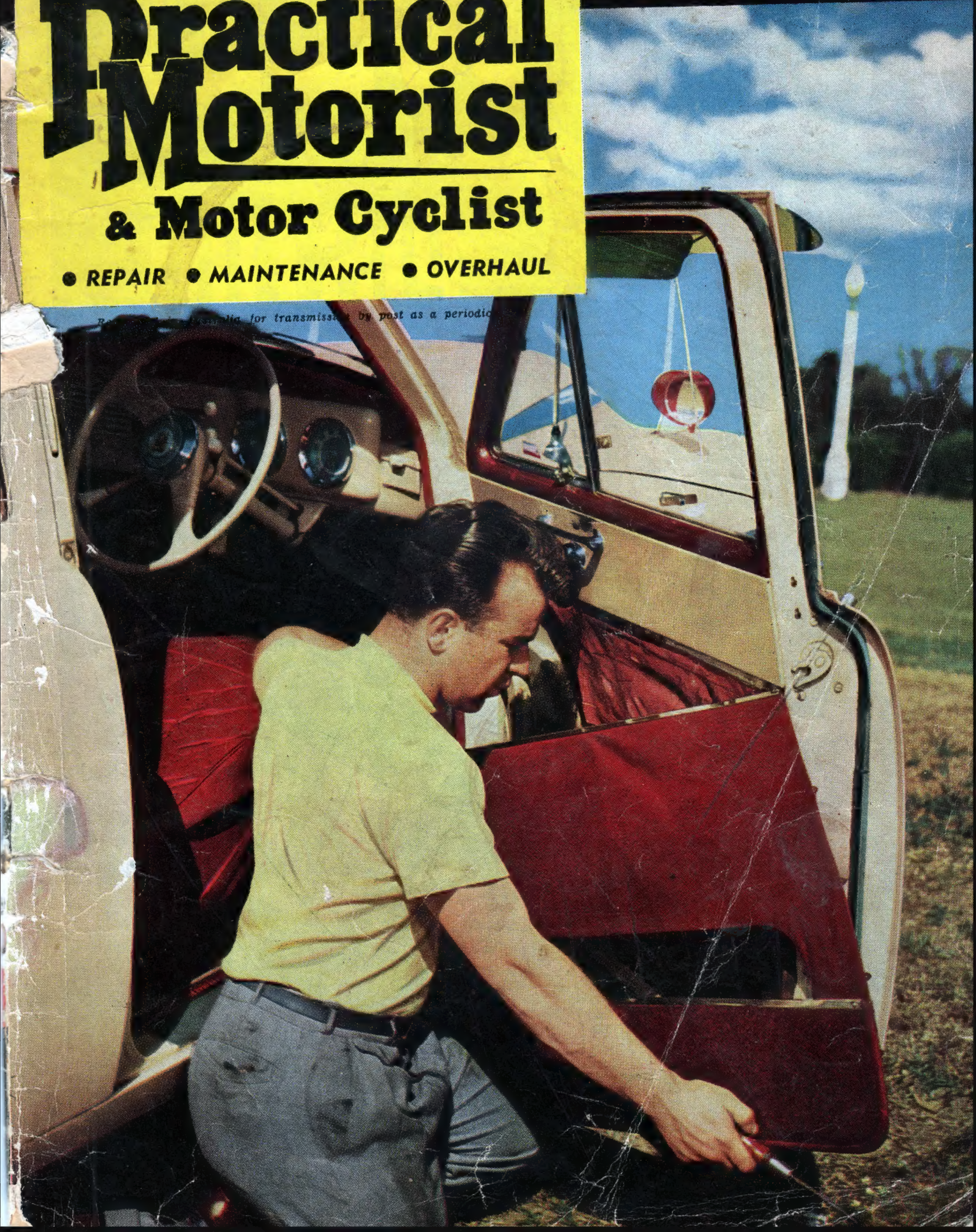


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Practical Motorist & Motor Cyclist

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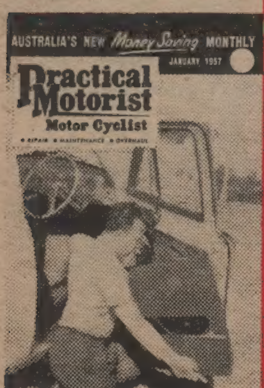

COVER: Removing door trim from Vauxhall Velox prior to repairing window winder. Article on p. 24 details winder repairs.

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EDITORIAL

"HOTTED" CARS

"I WANT to increase the compression ratio on my car. How much can I shave off the cylinder head to do this?" That is typical of the inquiries numerous readers are sending in to our "Experts Advise" page.

Pepping up standard models is certainly the vogue nowadays: motorists are naturally keen to get better performance from their engines and make full use of the higher-octane petrol now available. But the question of how to do it is not quite as simple as many seem to believe.

Two points that must be made straight away are these: 1. Many post-war cars, and even a few models produced in the late 30's, are already powered by high-compression engines. On some of these it would be inadvisable to try to increase the ratio still further. 2. In older cars that have seen a good deal of service the condition of the engine may be such that any modification, instead of promoting smoother and more powerful running, will only result in less satisfactory performance than before.

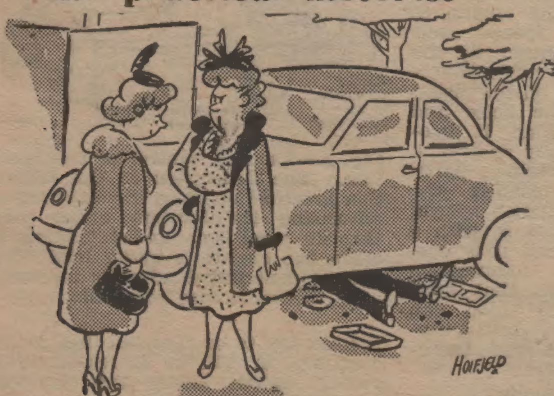
We felt this was a subject that deserved treating in greater detail than can be done in a brief paragraph or two. Result is the article appearing on page 6 of this issue. You'll see, when you read it, that shaving the cylinder head is not the only way of stepping up the car's power output. You'll see also why you need to be quite certain that your engine can take it before you think of adopting this method.

There are alternatives which often prove equally effective. But whichever you may decide to follow, along with the greater power that will result, you have to be prepared to accept certain disadvantages that can mean added running costs or a shorter working life for your engine. Driving a hotted car calls for a good deal more skill and mechanical know-how than are required to handle the average standard model, if the degree of wear and tear on the engine is not to be increased beyond a reasonable level.

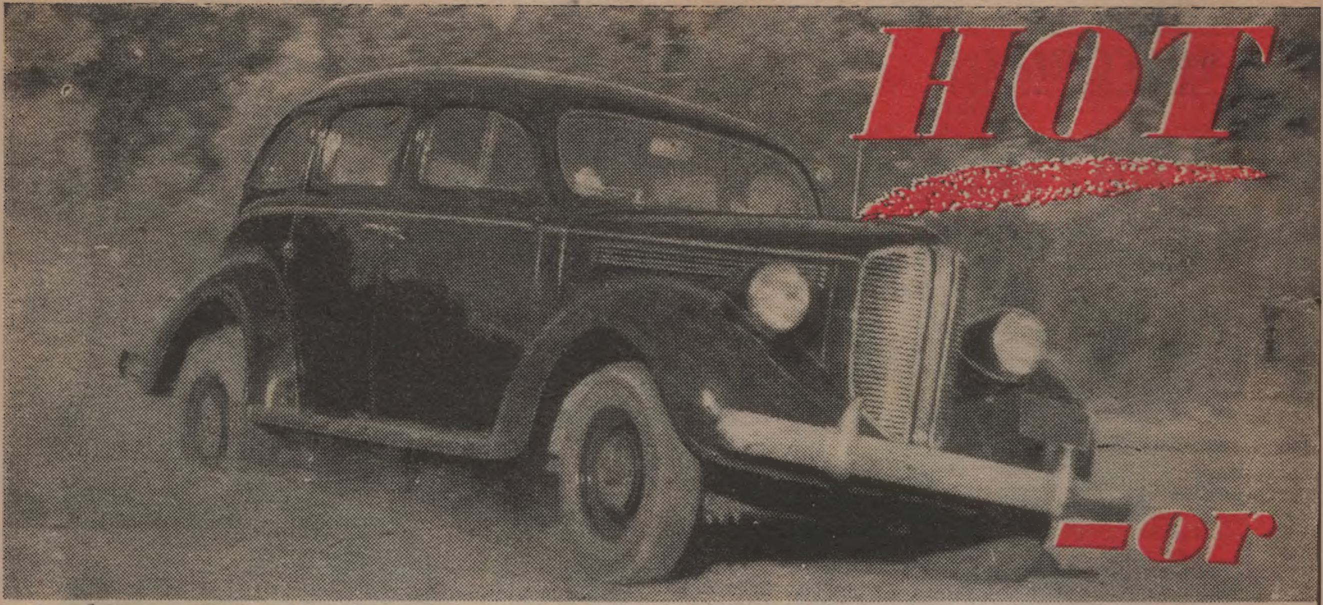
In these considerations lies the answer to the question: "Why don't all car manufacturers fit their products with high-compression engines in the first place?" Manufacturers are catering mainly for the average car buyer, who is looking for a vehicle that is pleasant and easy to drive, will enable him to keep maintenance costs to a minimum and will still perform reasonably well under normal handling conditions.

So if hotting the old jalopy is an idea you have at the back of your mind, better weigh the pros and cons pretty carefully before you get to work on it.

— the practical motorist —



"Sometimes I think he gets under there just to get away from me."



THE results of increasing the compression ratio are, in many respects, similar to those obtained by advancing the ignition timing, but this does not mean that both alterations are similarly efficacious in producing extra horsepower. When the compression ratio is increased it simply means that the incoming charge of petrol-air mixture is compressed to a greater extent before it is ignited by the spark. In consequence of this the force applied to the piston on the downward power stroke is made greater. By advancing the ignition timing the spark occurs between the points of the sparking plugs earlier; in most cases before the piston has reached the

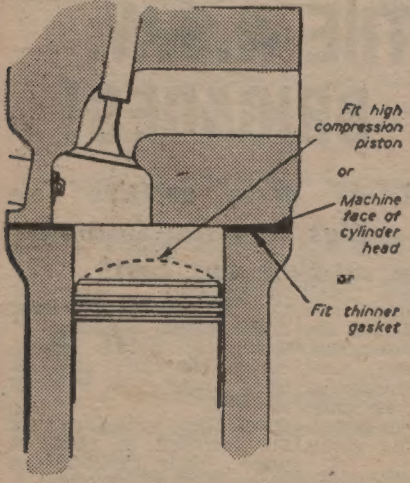


Fig. 1.—Methods of increasing compression ratio.

top of the compression stroke. This means, in effect, that the mixture tends to expand while it is actually being compressed. It can be seen that the action is at least comparable with that obtained when the compression ratio is increased.

AN OBVIOUS QUESTION

It would seem that either of these methods would give a useful increase in power output in a remarkably simple manner. Thus, it might be asked why don't manufacturers take advantage of them when building the engine. It is because of the attendant disadvantages which would

Fig. 2.—Typical alloy cylinder head.

make the car less satisfactory to the average owner. Obviously, increasing the compression ratio causes increased stresses to be applied to the pistons, connecting rods and big-end bearings; in turn, the stresses are also applied to the crankshaft and even to the transmission system.

Additionally, of course, there is a greater tendency for the engine to pink or knock unless special fuels are used. Pinking is caused by the sudden explosion of the mixture acting like a hammer blow on the piston crown. Apart from the noise and increased vibration which it produces, pinking also places additional strain on all of the working parts. One method of overcoming the trouble is to use a fuel with special anti-knock qualities; that is, with a high octane number. But it is possible to increase the compression ratio to such an extent that none of the standard "pump" fuels can be used in the engine without pinking taking place. A halt must, therefore, be called somewhere.

ESSENTIAL REQUIREMENTS

Those who propose to experiment with a higher compression ratio must, therefore, be prepared to be dependent upon anti-knock fuels and to drive the car in a manner which calls for more than average skill. Generally speaking, engine revs must be kept high, which means that the clutch must be slipped to a greater extent than usual when starting the car from rest, and that a change to a lower gear must be made earlier and more often than when the compression ratio is that standardised by the makers of the car. By driving in this manner, studiously avoiding low engine speeds, it might be possible to use the higher ratio without introducing an appreciably increased degree of wear.

The preceding remarks are intended to apply principally to the raising of compression ratio by the simple means, illustrated in Fig. 1, of using a specially thin cylinder head gasket, by having a small amount of metal planed off the face of the cylinder head, or by fitting high-crown pistons. When these methods are employed it

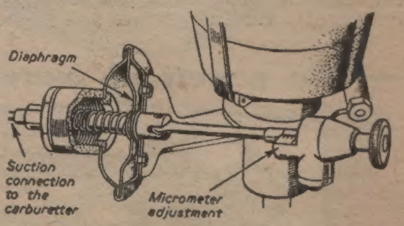
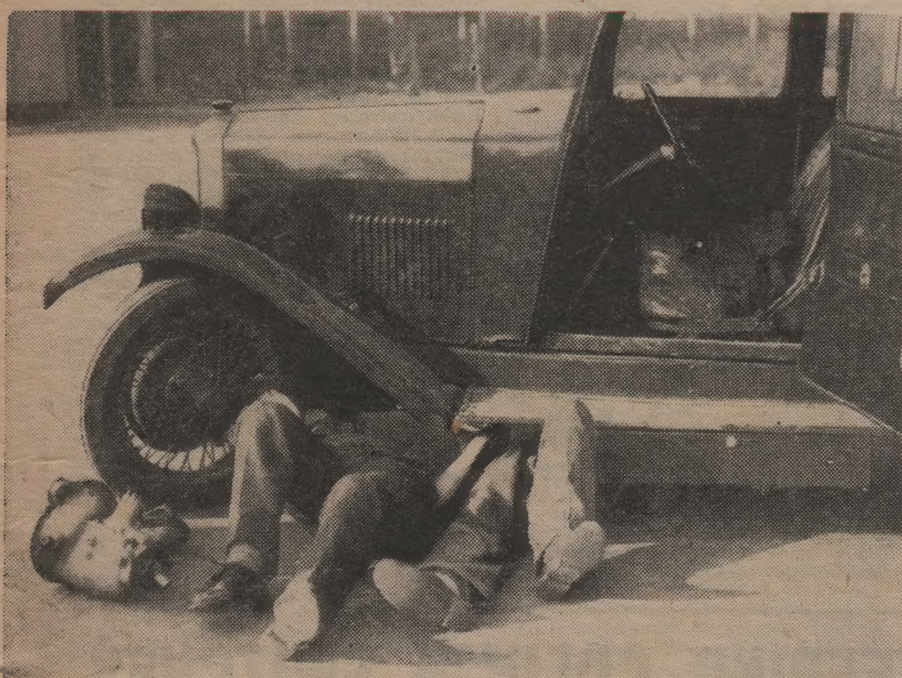


Fig. 3.—Vacuum control of the ignition. The depression in the induction manifold operates the diaphragm, advancing the ignition under part throttle conditions and retarding it when the engine is under load. The normal centrifugal advance mechanism is also retained.

is generally to be expected that petrol consumption will be increased to a certain extent unless the car was previously driven habitually at the highest speeds of which it was capable.

Not-So-Hot?

Stepping up compression ratio and ignition timing may mean more power, but there are some drawbacks



SPECIAL CYLINDER HEADS

The position is entirely different when a special alloy cylinder head, as shown in Fig. 2, is employed. In this case the head not only gives increased compression, but the combustion spaces are generally designed and made to a particular shape to prevent most of the disadvantages that have been mentioned. In fact, it is sometimes found — especially when making experiments with cars a few years old — that the higher compression alloy head actually improves engine performance at low as well as high revs, and has a slightly beneficial effect on fuel consumption.

Since many models already have high-compression engines it would certainly not be advisable to attempt to increase the ratio still more. In these cases a special head is already provided and the engine as a whole is suitably designed for the ratio employed. Quite a few 1938 and 1939 engines have a compression ratio in excess of six to one, whilst the "Flying" Standard engines have a ratio of 6.5 to one and a still higher ratio for the "Eight." The 2½-litre M.G. engine has a compression ratio of 7.25 to one; in this case the makers are careful to point out that either an ethylised or alcohol fuel should always be used.

SPECIAL SAFEGUARDS

It is impossible, however, to compare these newer engines with older types which have been hotted-up. The newer ones are designed throughout with a particular object in view; the older engines were made to be suitable for the fuels that were then generally available whilst their designers were often not in possession of the knowledge that has later been obtained from extensive research work. There are now various methods adopted to prevent the formation of local "hot spots" in the combustion chambers and for preventing burning of the valves and similar troubles which might result from inconsiderate and inexpert "tuning."

When it has been decided that tests are to be made with a higher compression ratio it is wise in the first place to make sure that the engine itself—particularly the bearings—is in perfectly sound condition. If it is noisy and "rough" in the first place it will probably be made worse in this respect. If it has a two-bearing crankshaft there is a danger that inexpert alterations to the compression will result in a crankshaft whip and, perhaps, in clutch slip. In a case of that kind it would generally be unwise to do other than obtain one of the specially designed alloy cylinder heads. Special types are available for many of the popular cars.

IGNITION TIMING

It has already been pointed out that advancing the ignition timing produces results similar to those obtained by increasing the compression ratio. When the alteration is made it certainly means that petrols other than those of the anti-knock type are ruled out if smooth running is to be retained, and that engine revs must always be kept fairly high. Here again it must be understood that the standard timing employed by the makers is the most suitable for normal use, and that if a more advanced setting were generally better it would have been used in the first place. If advanced timing causes the engine to pink, when using suitable fuel, the only sensible course is to retard it slightly until a point is reached at which the detonation ceases or is noticeable only when making a re-start on a hill.

There are various methods of altering the ignition timing, and one or two of those found most frequently on cars with automatic ignition control are illustrated. Any alteration should be very slight. After the alteration, carry out a road test and if necessary advance or retard a little more as a result of that.

EXTRA MANUAL CONTROL

Those who value performance will often find it well worth while to fit a manual ignition control which can be used in conjunction with the centrifugal-governor device provided in most automatic systems. This is especially useful when the compression ratio has been increased or when the ignition is to be advanced well beyond the normal setting. It is not generally a difficult matter to arrange a Bowden control, with a lever on the dashboard or steering column. Methods of connection are illustrated. It will be seen that a slotted replacement clamp is fitted to the distributor

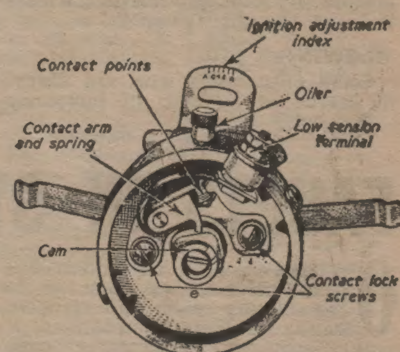
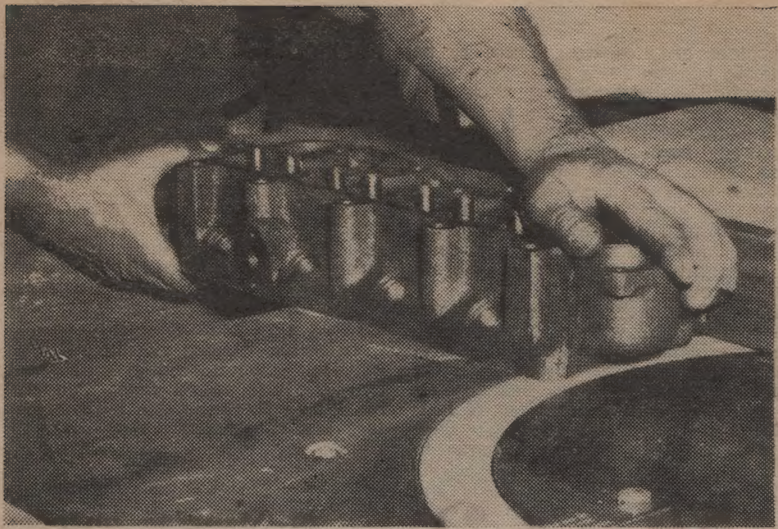


Fig. 4.—Variation in ignition timing can often be made by slackening a stud, allowing a slotted plate (sometimes with an index scale) to be rotated, so turning the complete distributor.



(Left) Shaving cylinder head on horizontally mounted grindstone. (Right) Face of head when shaving is complete.

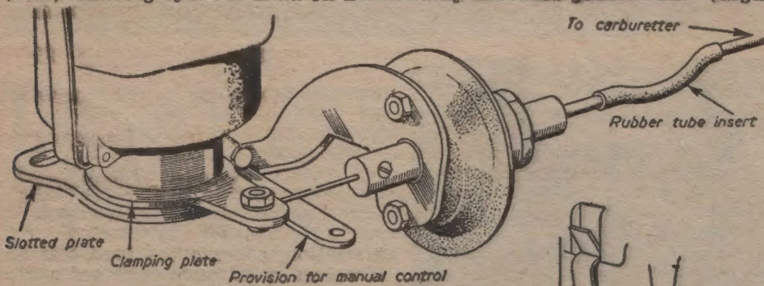
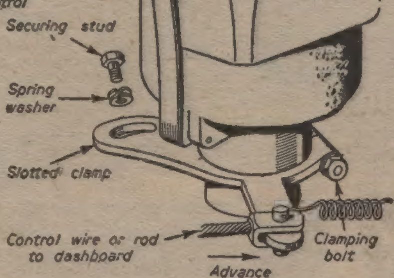


Fig. 5.—Three methods of providing manual ignition control. The three illustrations also show the securing stud and slotted plate by means of which the initial timing can be set.

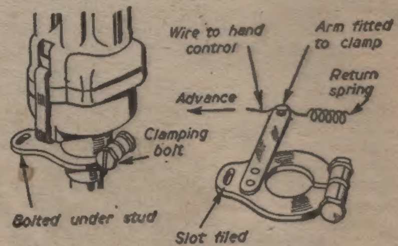
body to permit this to be rotated through a few degrees. The centrifugal governor continues to operate in the normal manner, because that acts on the rotor and not on the main body of the distributor.

BLOWING

Some enthusiasts who are always in search of methods of improving



performance might contemplate the fitting of a low-pressure blower or supercharger. This often proves very effective provided that a blower designed for use with the particular engine is chosen, but in many cases it is necessary to modify the engine, at the same time ensuring that it will be capable of withstanding the heavier stresses that are thrown upon the working parts. Actually a blower working at low pressure produces a result quite comparable with that of increasing the compression ratio. It simply means that a greater volume



of mixture is forced into the cylinders and therefore that the mixture is compressed to a greater extent.

FAULTS IN STEERING COLUMN SWITCHES

OWNERS of older cars often find that the switches mounted on the steering column give trouble. Faults are usually confined to points such as disconnected leads, chafed insulation, faulty contact between connecting surfaces, or a broken toggle spring.

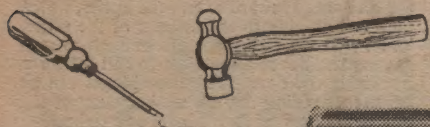
If the fault is not apparent from external examination of the switch in operation, suspect broken connecting leads or worn insulation. Another trouble spot is where the leads enter the column base.

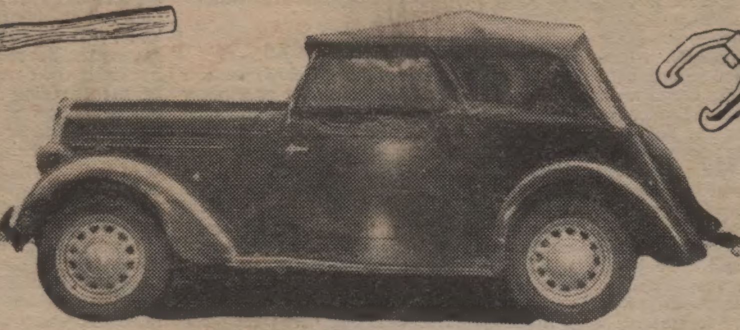
The most likely cause of the horn blowing continuously, if the horn switch is not jammed, is a short circuit to earth in the wire leading to the horn push. Similarly when trafficators or headlamp dippers fail to operate properly, don't blame the switches before you make sure the trouble is not with the mechanism or external wiring. Nevertheless, note that on some cars with twin-filament headlamps a fault in the dipping switch may cause both filaments to be switched on intermittently, imposing a drain on the battery unless the fault is detected and cured.

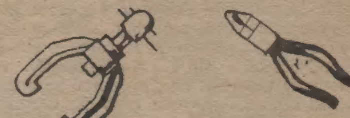
The trouble usually lies in the combined horn and dipping switch carried, in many cases, on an extension clamped to the steering column. Slack off the clamp and withdraw the switch, revealing the mechanism. The spring in the switch may be fouling one of the wires. Should the insulation be chafed, insulating tape will cure the trouble. Alternatively a loose strand of wire from one of the terminals may be touching the spring. Should it be necessary to disconnect any wires from their terminals, the horn switch must be detached.

In earlier-model cars, if the control plate on which the throttle and ignition controls work becomes loose, tending to move with either control lever, tighten the clamping nut securing the plate. It is sometimes found, however, that the split collar meets so that further tightening is impossible. In this case, detach the control levers from the lower ends of the tubes at the base of the steering box, and withdraw the tubes and levers. Remove the control bracket and, with a hacksaw, widen the slot so as to provide sufficient clearance when tightening the clamping bolt.

STANDARD 8 OVERHAUL







Final Part: Servicing steering gear and electrical system on the 1939 model

THE "Eight" is fitted with Burman Douglas steering gear which is of the worm and nut type. The drop arm is provided with a ball peg which fits into a bush in the nut, while the end-thrust on the gear is taken by a ball race at the top of the steering column. This race is of the adjustable type, and end-play can be taken up by slackening the locknut and tightening the lower adjusting nut. The adjustment, situated beneath the steering wheel, however, is a further task which is best left to a Standard dealer, especially is it should be required only at very infrequent intervals, as is the case when wear eventually develops in the worm and nut. In this case the steering gearbox must be completely dismantled, and a new worm and nut must be fitted. The parts are supplied in pairs lapped together, and it is useless to fit a new nut to an old worm. If the owner should tackle the removal and dismantling of the steering gear-box, the main point to be borne in mind is that the drop arm must be correctly replaced on the rocker shaft. It is safest to mark both the drop arm and the shaft before removal.

On replacing the drop arm and the steering gear-box check the lock in each direction. The distance through which the front wheel turns is limited by setscrews and locknuts in the vertical arms which carry the stub axles, and, if necessary, these should be adjusted so that the steering arms meet the stops before the nut reaches the end of its travel in the steering gear-box.

If, after considerable use, the front hub bearings become worn, resulting in appreciable slackness of the front wheels, jack up each wheel and remove the hub cap. Extract the split pin from the castellated axle nut and screw the nut up as far as possible. Then slacken it back by two or three split-pin slots.

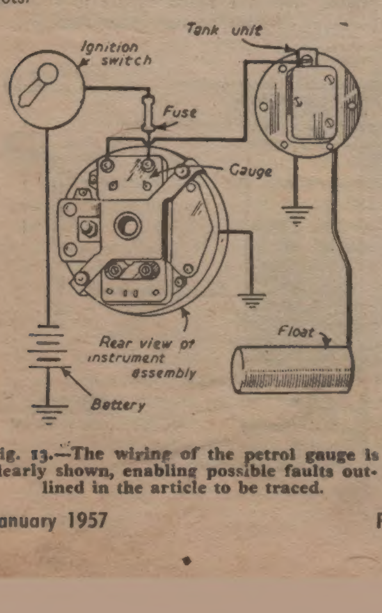


Fig. 13.—The wiring of the petrol gauge is clearly shown, enabling possible faults outlined in the article to be traced.

ELECTRICAL SYSTEM

The capacity of the 6-volt 51 amp.-hour battery should prove sufficient, provided that the ventilating third brush generator receives occasional routine attention. First of all the charging switch must be operated according to the demands made on the battery; the switch can be set to "high charge" or "low charge," depending on whether the headlamps are in use to a large extent, and whether a frequent number of stops is made, calling for repeated use of the starter. In addition to the positions of the switch on the dashboard, incidentally, there is a super-charge which only comes into operation when the headlamps are switched on.

With the lamps switched off, from 7 to 8 amp. should be recorded with the switch at the "low charge" position and from 9 to 11 amp. on "high charge." If the charging rate does not approximate these figures, it can be adjusted to reduce the output by moving the control brush, which is the thinnest of the three revealed when the dust cover is removed from the generator, slightly in the opposite direction to that in which the armature turns. It should never be necessary to increase the output by alteration of the third brush unless the original setting has been altered.

GENERATOR BRUSHES

Any falling off in charging efficiency can usually be traced to a dirty or pitted commutator, chipped or broken bushes, or brushes which are gummy and binding in their guides. At fairly long intervals, therefore, it is a wise precaution to remove the dust cover from the generator, carefully raise the brush springs and extract the brushes. Clean out the brush guides with a clean cloth dipped in petrol, and clean the commutator by rotating it after slackening the belt. If the commutator is slightly burnt it can be burnished by pressing a strip of fine glass paper against it with a flat piece of wood, but if it is badly pitted the generator should be returned to the local Lucas service agent for attention.

When replacing the brushes see that they bed down properly on the commutator, and make sure that the brush springs have not lost their tension. Do not try to increase the spring tension unnecessarily, however, as this will simply lead to rapid wear of the brushes. Finally, remember that the generator belt tension must be correct; a slipping belt will reduce the generator output. Adjust the belt by swinging the generator round in its cradle, and tighten the nut while holding the generator in position. Do not over tighten the belt, as this will simply place a heavy load on the generator bearings.

FUSES

Two fuses will be found in the junction box. One protects generator windings, the other serves the horn and roof lamp. The direction indicators, petrol gauge, reversing and stop lights, and the windscreen wiper are protected by a separate fuse. Always replace a burnt-out fuse by the spare which is housed alongside each fuse clip, and replace the spare fuse as soon as possible with one having the same amperage marked on the coloured slip inside the glass. In order to attend to the dipper fuse, remove the nearside lamp front, and then release the screw fitted at the back of the lamp, thus allowing the reflector unit to be released from the two clips holding it at the front. A spare fuse is provided in a clip.

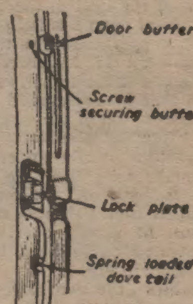


Fig. 14.—Door lock plates and rubber buffers on door pillars are adjustable, use being made of slotted fixing holes in the buffer and in the pillar.

DIRECTION INDICATORS

The self-cancelling direction indicators, which are operated by a switch at the centre of the steering column, should not ordinarily require attention, apart from occasional replacement of the bulb should an indicator fail to light up when the arm rises. In order to renew the bulb switch on the indicator, and while supporting the arm in the horizontal position, return the switch to the "off" position. Remove the screw on the underside of the arm, and slide off the metal plate; the bulb can then be replaced. When replacing the plate make sure that its side plates engage with the slots on the underside of the spindle bearing, and do not forget to replace the fixing screw firmly. Periodically, it is a good plan to raise the arm as just described, and to apply a little machine oil to the spindle and pivots at the inner end of the arm with a small camel-hair brush. Do not use heavy oil as it may clog the mechanism. Practical experience indicates that a processed oil not only prevents sticking, but will often cure any reluctance of the arm to return to its socket.

PETROL GAUGE

The electric petrol gauge (Fig. 13) should prove accurate in normal service, but should the gauge persistently indicate "full" or "empty" it is not usually a difficult matter to trace the cause. If the meter reads "full" whenever the ignition is switched on in spite of lack of petrol in the tank the cable leading to the tank unit is probably disconnected, and once the fault has been discovered and made good the meter should read correctly. Alternatively the tank unit may not be making a good electrical contact with the petrol tank. Unscrew the ring of screws around the edge of the flange. Carefully lift out the unit, taking care not to bend the float arm, and clean the body of the unit and the fixing ring, also scraping away any enamel from the edge of the tank. Take care not to dislodge any enamel or grit into the tank itself.

If the meter reads "empty" in spite of the ignition being switched on and there being petrol in the tank the wire supplying the meter from the ignition switch and fuse may be broken or disconnected. If current is reaching the meter make sure that the case of the meter is properly earthed to the instrument panel. Possibly the insulation of the cable leading to the tank unit is frayed, and the wire is short-circuiting to a chassis member.

Faults which cannot be dealt with by the owner are a faulty meter or earthing of the terminal on the tank unit. In either case the meter or the tank unit should be turned in for expert mechanical attention.

DOOR BUFFERS AND LOCKS

The sturdy chassis of the Standard ensures a commendable freedom from door or window rattles. The doors are, however, provided with rubber buffers and spring-loaded dovetails, thus enabling any rattles which may develop to be easily dealt with. Naturally, the makers recommend that any adjustments should be left to a coachbuilder or the local Standard service station since incorrect adjustment may strain the door flanges and eventually make matters worse. When necessary it is possible, however, to proceed carefully on the following lines.

In the first place, wear may have taken place on the lock plate in the door pillar. This is secured by four countersunk screws; after removing these, the lock plate can be removed and the worn flange can be filed true. The plate is then refitted and, with the screws slightly slackened, can be moved inward or outward until the door closes comfortably.

The rubber buffers are also adjustable. Slacken the screws shown in Fig. 14 and press the screwhead inward to free the buffer, which may be adhering to the interior of the pillar. Then pull the buffer out just enough to stop any rattles, but not sufficient to call for force in closing the door. The door hinges can be adjusted bending the tab washer clear of the nut at the base of each hinge, and tightening the nut sufficiently to make up any wear on the ball and spherical cups of the hinge, which is of the self-aligning type. Carefully bend back the tab washer after adjustment to lock the nut, taking care not to break off the locking tab.

Finally, do not overlook an occasional trace of lubricant on the door locks and the spring-loaded dovetails. In this case use for preference one of the solid "stick" types of lubricant, which will not soil the passengers' clothes; otherwise, use ordinary machine oil sparingly.

Make an Air Filter

Cure for engine roar in older cars

In some older cars lack of an air filter may cause excessive engine roar. You can make your own filter this way:

First prepare for soldering a length of copper tubing of suitable diameter and chamfer one end to make a perfect union with the inlet of the carburettor.

Next bend a small piece of 18 gauge brass or copper sheet in the form of an "L" with one face hammered concave to fit snugly against the external wall of the intake tube. A hole (to correspond with the screw thread hole on top of the carburetter) is then drilled in the flat (horizontal) face of this angle, which is finally soldered to the wall of the intake tube. (See Fig. 1).

A band of non-ferrous metal is cut—either from a sheet or the end of a tube which will fit snugly over the intake tube—and sweated or soldered to the intake tube as shown in Fig. 1.

Next, the two halves of a polish tin are carefully cleaned and any paint removed by burning. The lower tin then has a hole drilled into it to fit over the intake tube, where it is firmly soldered in position against the ring 1A.

TEMPORARY FITTING

At this stage the fitting should be temporarily screwed to the carburetter to ensure that it is firm and not likely to work loose or admit air owing to bad seating. Also, the large diameter of the tin will prevent the original screw from being tightened with a screwdriver, and thus a hexagon-headed screw should be substituted. The fitting is shown in Fig. 2.

Two pieces of 22 gauge gauze should now be cut and bent to form two concentric tubes, one of which fits tightly over the intake tube and the other just rests inside the outer upstand of the base tray. The seams should then be joined either by soldering, or as an alternative, by marrying up two rows of perforations and then bolting together with a couple of Meccano nuts and bolts. The smaller tube is then soldered in position over the projecting portion of the intake tube above the base tray. (See Fig. 3.)

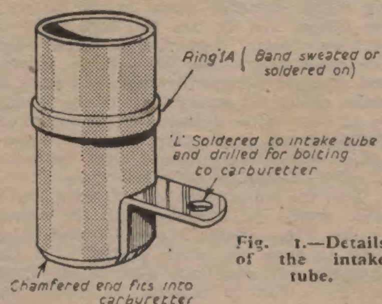


Fig. 1.—Details of the intake tube.

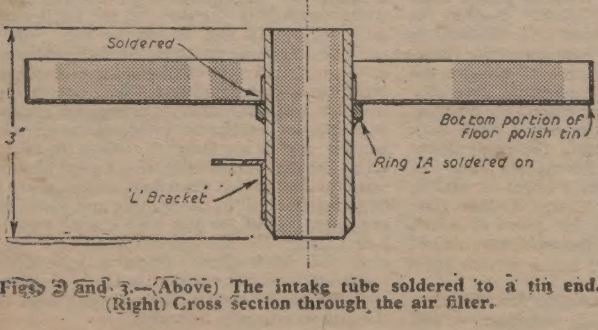
STABILISER

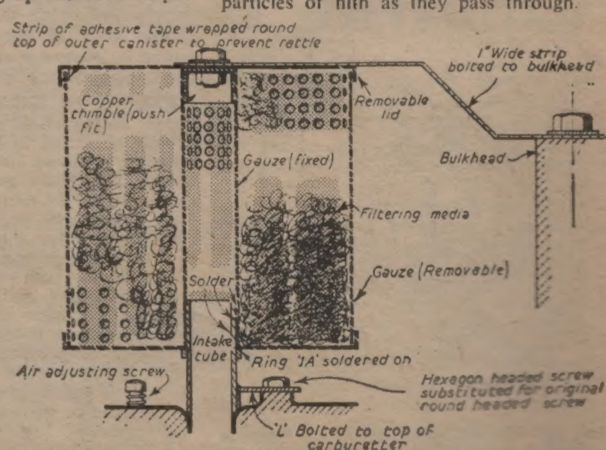
Finally, a thimble is made by cutting a ½in. length of tube from the pipe which supplied the original intake tube and soldering one end of this to a flat piece of copper sheet. After filing away the surplus edge, this thimble can then be bolted to the inside portion of the polish tin lid to form a stabiliser, which will help to keep the top and bottom (lid and tray) of the filter in line with each other.

The last stage is now only a matter of assembling the outside mesh cylinder, inserting the filtering media and placing the lid in position, after which the whole unit can be bolted to the carburetter. For further stability, a length of brass sheet or other metal about 1in. wide and long enough to reach the bulkhead can be drilled at each end and bolted to the lid and bulkhead, respectively, and if the metal strip is cranked, the resultant spring action will keep the lid in a closed position and prevent further vibration.

FILTERING MEDIA

The filtering media can be a set of three nylon pot scourers with the central fastening removed (so that each one opens up and resembles a doughnut). These are laid one on top of the other inside the perforated canister. Thick gearbox oil is then poured over the nylon media to trap the particles of filth as they pass through.





Figs. 2 and 3.—(Above) The intake tube soldered to a tin end. (Right) Cross section through the air filter.

WHEN THE ENGINE "RUNS ON"

● *Solution for a puzzling problem*

THE term "running on" is sometimes confused with the term "pre-ignition." The two are related in so far as the cause of each may be the same, but they occur under different conditions.

"Running on" refers to the engine continuing to run after the ignition has been switched off, combustion in the cylinders being effected by something other than the electric spark at the plug points. Pre-ignition on the other hand is the term used when referring to the engine running under normal electric ignition and medium to heavy load, that is the vehicle is climbing or is being accelerated, and the mixture being fired before the correct time. This causes "detonations," the metallic knocking sound produced by the expanding gases acting against the piston which is still rising towards the end of the compression stroke.

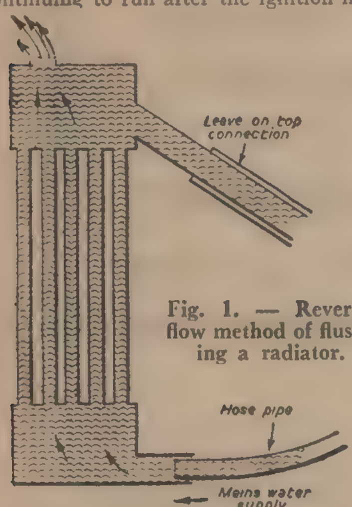


Fig. 1. — Reverse flow method of flushing a radiator.

The phenomenon of the engine continuing to run after the ignition has been switched off can cause the owner-driver some anxiety, since the after running may be very erratic, uneven and accompanied by heavy thuds due to incorrectly timed explosions.

STOPPING THE ENGINE

To stop the engine when suddenly confronted with this phenomenon can present a problem to many. Frantically turning the ignition switch on and off and then perhaps disconnecting leads to the battery are of no avail, and only waste time. Disconnecting the petrol pipe at the carburetter will eventually result in the engine stopping, but it will continue to run until the petrol in the float chamber has been used.

Best way to stop the engine is to sit in the driving position and with the ignition switched off engage a low gear and let the clutch in slowly. The engine, most likely, will continue to run, and the car will move forward. Then gradually apply the brakes which will force the engine to stop. The result may be obtained satisfactorily by engaging the top gear and letting in the clutch slowly, but care must be taken to avoid damage to the transmission by sudden shock.

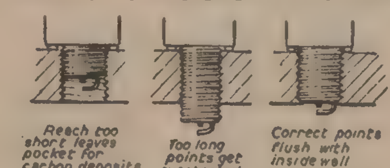


Fig. 2.—It is important to use plugs of the correct reach.

There are a good many possible causes for an engine to run on. Seldom is it the result of a single defect.

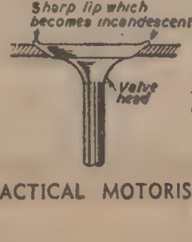


Fig. 3.—Sharp edges on valves should be smoothed off.

The following are possible causes: (1) Overheating; (2) Carbonisation; (3) Wrong plug reach or type; (4) Metal protrusions; (5) Compression too high.

OVERHEATING

One of the principal causes of overheating is a partially or wholly blocked cooling system.

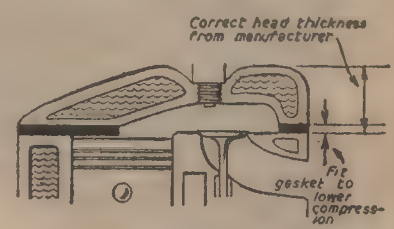
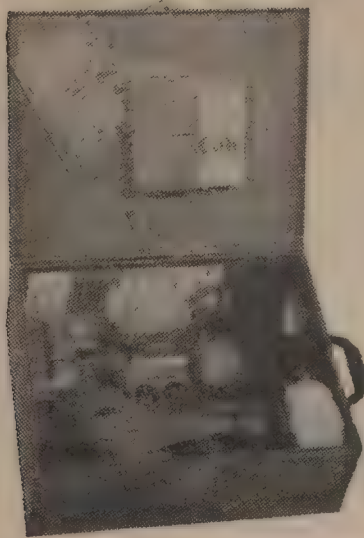


Fig. 4.—Compression ratio of an engine can be lowered by fitting a gasket of the correct thickness.

The cooling system does not in general receive the attention it deserves. The bottom hose from the engine to the radiator should be disconnected occasionally and the radiator and engine water jackets flushed out. It should be remembered that when a car is fairly old its radiator may be partially or wholly blocked by sediment and corrosion. Cure can be effected by using one of the special compounds for flushing out radiators.

If normal down flushing does not improve the flow, the reverse flow method proves very effective. A hose pipe is connected to the bottom outlet from the radiator and with the top hose removed water is forced upwards under pressure and out of the radiator filler cap.

Other causes of overheating leading to running on are: (a) Thermostats not working properly; (b) Retarded ignition; (c) Valve timing out; (d) Excessive carbon deposits in combustion



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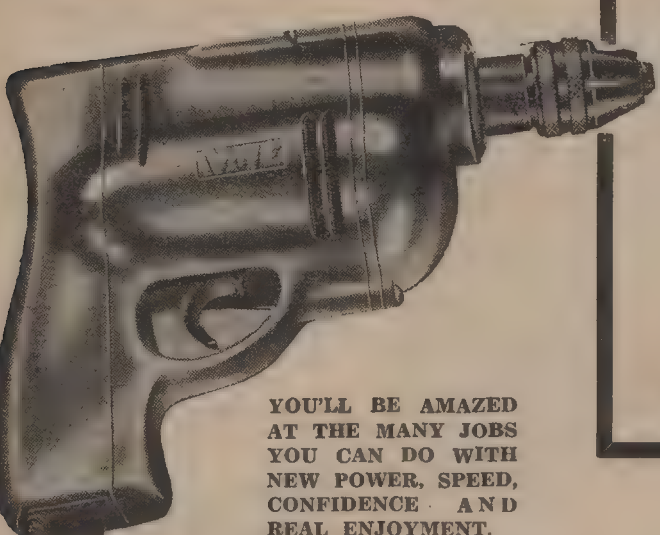

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CARBONISATION

Carbon is a great retainer of heat, and deposits build up in crevices and corners inside the combustion chambers. These deposits rapidly form small peaks which become hot spots and reach temperatures sufficiently high to make them incandescent. These hot spots continue to fire the charge when the ignition is switched off.

Any roughness on the inside of the combustion chamber helps the formation of carbon deposits. Therefore the smoother the casting, the greater is the difficulty for carbon particles to adhere to the surface. It is impossible, however, to prevent some carbonisation in an engine and if it has done over 10,000 to 15,000 miles de-carbonising becomes necessary.

Excessive carbonisation can be due to mechanical defects and other factors. The oil should be checked for correct grade, level and pressure. Big end wear causes excess oil to be thrown on the cylinder walls and to be pumped past the rings into the combustion chambers. Over-oiling also occurs when the bores, pistons and rings are worn. Too rich a mixture will also help carbonisation.

WRONG PLUG REACH OR TYPE

It is important that the manufacturer's recommendation regarding the make and type of plug should be followed. Sparking plugs differ from one another, despite great similarity in external appearance. One important difference is known as the heat coefficient or characteristic. A plug which is correct for one engine can run "too hot" in another kind of engine; the points may reach incandescent temperatures and so cause running on. Alternatively, an incorrect type of plug may run "too cold," a result being incomplete combustion under certain conditions and heavier carbonisation round the plug electrodes.

The importance of using plugs of the correct reach cannot be overemphasised. The reach of a plug is very much the same length as the thread in the cylinder head. Experiments have shown that the best position for the spark gap is in line with the inside wall of the combustion chamber (see Fig. 2). If the reach is too short the spark is pocketed, and this, besides making a pocket for carbon to form, results in bad starting and in uneven firing on slow running. If the reach is too long, the points protrude into the combustion chamber, get overheated, and thus cause pre-ignition.

METAL PROTRUSIONS

Castings such as cylinder heads come from the foundry mould with fairly rough surfaces. Then surfaces are subjected to a sand-blasting. This process tends to remove small particles of metal from the surface and make it much smoother. Sometimes, however, a small particle escapes the sand blast and remains attached to the surface of the casting. Such a particle left inside a combustion chamber can very quickly become incandescent, similar to carbon hot spots. Any metal protrusions like this should be carefully smoothed off.

Other protrusions may be the sharp jagged edges of old cylinder head gaskets extruding into the combustion chamber or a sharp edge where the cylinder head or block has been machined. The sharp edge of the valve can act in the same way, especially if the edge has become lipped (Fig. 3).

COMPRESSION TOO HIGH

After a cylinder head or block has been welded the casting is usually found to be warped. This is due to the intense localised heating by the welding torch. To reduce distortion and prevent fracture, castings should be pre-heated before the welding takes place, but even so the distortion is appreciable and it becomes necessary to machine the fitting face. This removal of metal means that unless a gasket is fitted to compensate for the thickness of metal removed, the combustion chamber is reduced. This increases the engine compression ratio. Ignition is being effected by the air and petrol mixture rapidly rising in temperature under the sudden compression, causing instantaneous combustion.

To correct the trouble a thicker gasket or special steel plate should be fitted. These can be obtained in various thicknesses. The correct thickness may be found by trial and error or by obtaining from the manufacturer's agent the correct height of the cylinder head and then making up this dimension by means of the gaskets.

REAR HUB PULLER

● *Make this tool for your Ford 8, 10 or Popular Van*

It is not usually possible to remove Ford rear hubs unless a special type of puller, quite expensive to buy, is used. Here's how to make a simple and effective tool that does the job in quick time with minimum effort.

Obtain from your local Ford agent an old and discarded half-shaft. Place the shaft in a vice and cut off ⅛in. from the threaded end, leaving about 3/8in. of thread. Then cut off about 2in. of shaft beyond the recessed edge where the thread stops. You are now left with a stub of about 2 3/8in. length with one end threaded to receive a nut.

Screw on the nut in reverse, the castellated side of the nut to the stub, leaving the normal starting thread outermost and ready to be screwed on to your car's half-shaft in due course. You may find some difficulty in starting the castellated end of the thread, but so long as the two faces are quite parallel to each other you should be able to manage this. Be sure to screw the nut up tightly.

USING THE TOOL

Having jacked up the car and removed the wheel, turn back the brake adjusting wedge completely. (This is the square stud on the back of the backplate at the top.) The number of clicks made by the wedge may be counted if it is intended to use the existing brake shoes, so that the brakes may be reset as they were originally.

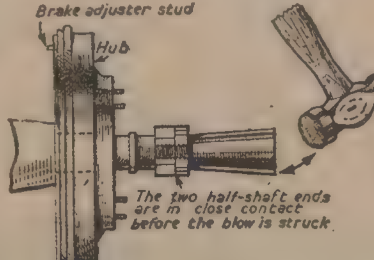


Fig. 2.—The tool in use.

Release the handbrake and, if neces-

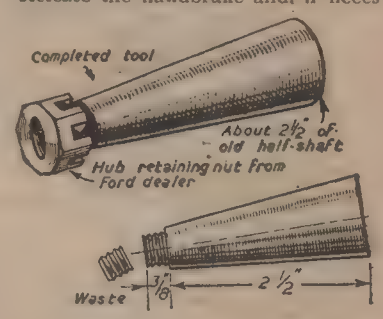


Fig. 1.—How the tool is made from a discarded half-shaft.

sary, brace the lever in the forward position. This is important because if the brake shoes are in contact with the hub, they not only hinder its removal but may also be damaged.

Remove the split pin from the retaining nut and remove the nut and thrust washer. Now you are ready to put your tool to use. Screw on the nut on the stub end of the tool and draw it up tightly. The two half-shaft ends —stub and your working one—must be in absolutely firm contact so that no damage may be done to the threads.

The function of the "drawer" is now clear. With a hammer strike a sharp blow on the end of your puller. Rarely are more than two or three blows necessary before the hub slides forward on to the tapered half-shaft and key. The puller may then be unscrewed and the hub removed from the shaft.

Has your car lost its PEP?

● Here's how to find out why and remedy the trouble

UNDER normal running conditions the performance of a car so slowly deteriorates that the owner is not aware of the fact until certain road conditions—as for instance, a fairly steep hill that was previously easily negotiated in top gear—necessitates a change of gear. This falling-off in performance is usually accompanied by an increase in the consumption of fuel and also oil if the cylinder bores and piston rings are showing signs of wear. A good method to ensure that the car is running at its normal efficiency is to time its rate of acceleration in top gear from 30 to 50 m.p.h. periodically, say, once a month. The same stretch of road and fuel should be used, and the same weather conditions observed as far as possible. Calm days should be chosen for the tests for a head or following wind can upset calculations. If a log or record is kept of the test runs, any depreciation in performance will be quickly ascertained and the appropriate corrective measures taken.

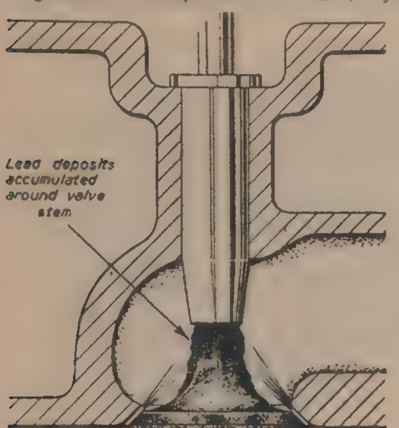


Fig. 1.—There is a tendency in some fuels to form a deposit around the valve stem, thus eventually preventing the valve from completely closing and resulting in burnt seatings.

DEPOSIT ON EXHAUST VALVE STEM

Nowadays, the amount of carbon and burnt deposits that accumulate on the cylinder heads and piston crowns is very small indeed and will not have an adverse effect upon the performance until a very large mileage has been covered. However, many modern fuels contain an anti-knock constituent of lead tetra-ethyl which, if not inhibited by a suitable additive such as bromide, will tend to build up a deposit of lead salts around the exhaust valve stem. These deposits are extremely hard and scaly and eventually so accumulate that they prevent the free working of the valve stem in its guide and the valve fails to close completely and tightly upon its seating (Fig. 1). As the gases are at their maximum pressure and temperature soon after ignition, the valve and port seatings are subjected to the force of the escaping charge at elevated temperatures and pressures and warped valves and burnt seatings quickly result under these running conditions. Some valve guides are undercut or recessed to shroud or shield that portion of the valve stem that works in the guide (Fig. 2), and in these designs it is often possible to run for quite considerable periods without an undue deposit accumulating. With the normal design of valve guide as shown in Fig. 1, however, a periodical decoking, a thorough cleansing of the valve stem and guides together with a careful grinding-in or refacing of the valve and port seatings, is absolutely essential to maintain the engine at its full efficiency.

BORE AND RING WEAR

A gradual but steadily increasing loss of performance is inevitable due to cylinder bore and piston ring wear. This is associated with a smoky exhaust and increased oil consumption. The rate of wear can be considerably reduced by changing the oil and oil-filters at the recommended intervals, by the periodical cleansing of the air-filter, and also by the minimum use of the starting choke and warming the engine as quickly as possible upon starting from cold. The use of an upper cylinder lubricator dispenser and multi-grade engine oils are also worthy of serious consideration to reduce the rate of cylinder bore wear.

If the car in question is equipped with a starting handle it is a simple matter to check up on the condition of the bores and rings. The engine is run for a few minutes to warm up and after switching off the throttle is opened and the handle slowly turned when the compression of each cylinder can be felt. The compression resistance should have an elastic quality and should be uniform on all cylinders, and if one cylinder offers considerably less resistance than the others it is a certain indication that attention is needed. Loss of compression, however, does not necessarily imply that it is due to worn bores or piston rings, for the trouble can be caused through burnt valve seatings or to incorrect tappet adjustment. As a check, the valve cover should be removed and the valve clearances inspected, slowly turning the handle as necessary. If the trouble has been caused through insufficient inlet-valve clearance, probably the seatings have suffered no harm, but with an exhaust valve, burning of the seatings is almost certain to have occurred and regrinding or refacing will be necessary. Incidentally, an indication of insufficient inlet valve clearance is usually spitting and back-firing through the carburetter.

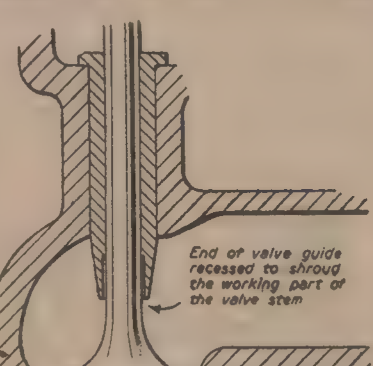


Fig. 2—On some engine designs the valve guide is recessed. This shields the working stem of the valve from harmful deposits.

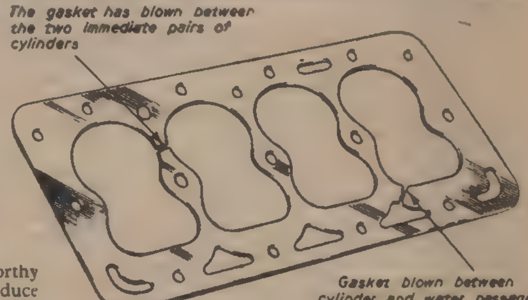
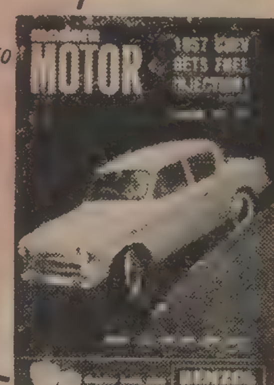


Fig. 3.—When two immediate pairs of cylinders have a loss of compression, it is often due to a blown gasket. A severe loss of compression on one cylinder is often due to a blown gasket between the cylinder and water passage. The text describes the signs to look for.

If the tappet settings are correct, the engine should be allowed to cool down and the sparking plugs removed from the respective faulty cylinder or cylinders, and approximately two teaspoonfuls of No. 30 S.A.E. engine oil carefully poured through the orifice. With a s.v. engine this presents no problem, but with an o.h.v. unit a force feed oiler may be necessary. The sparking plugs should be replaced and the engine cranked with the starting handle. If the defective cylinders have then regained their compression it is indicative that the trouble lies with the bores and rings, for the oil has temporarily sealed the excessive clearances and stopped the blow-by of the compression. Should, however, the compression still be weak or absent, the trouble is due to the valves. It should be mentioned, however, that when the compression is absent from two immediate pairs of cylinders, the trouble can be often due to a defective gasket, as shown in Fig. 3. Where this has occurred the affected cylinders are usually out of commission and pronounced misfiring occurs. Another possibility where the loss of compression is confined to one cylinder is that the cylinder head gasket has


MOTOR

blown adjacent to a water passage (Fig. 3). Usually, a loss of water occurs which can be detected in the sump on the dip-stick, and a film of oil can be seen floating on the cooling water when the radiator cap is removed.

CHECK WITHOUT CRANKHANDLE

Where a car is not fitted with a starting handle a general indication of the bore and piston ring wear can be assessed by the increased consumption of engine oil and the oil smoke discharge from the exhaust. Excessive wear can be confirmed by removing the oil-filler cap and carefully listening whilst the engine is slowly running. A continuous series of gas puffs indicates that blow-by is occurring past the pistons. The best method of testing the internal condition of an engine which is not provided with a handle, however, is by a testing gauge. A good instrument is rather expensive, however, and will probably not justify the expense involved for just an occasional check-up. You may be able to buy a tyre gauge complete with sparking plug adaptor, which should prove very useful for the dual purpose for which it is intended.

The sparking plugs are removed from the engine and the gauge screwed into the plug orifice, commencing with No. 1 cylinder. The throttle is then fully opened and the self-starter engaged for a few seconds, meanwhile making a note of the maximum reading shown. The gauge is then removed and inserted into the next cylinder, and the same procedure made and so continued until all the cylinders have been tested. If the maximum and minimum readings do not exceed 10 per cent. the condition of the bores, rings and valves can be regarded as satisfactory. Should the readings deviate from these figures an oil-sealing test to determine the source of the compression loss will be necessary. This is done by injecting two teaspoonfuls of No. 30 S.A.E. engine oil into the sparking plug orifice of the faulty cylinders, immediately inserting the pressure gauge and taking a further reading by following the previous procedure. If the defective cylinders are then raised to a satisfactory level, the loss of compression is due to bore and ring wear. Should, however, the reading remain substantially the same, then the trouble lies either in pitted valve seatings or a defective cylinder head gasket. With a gauge test it is possible to compare the compression pressures of all cylinders with those of a new engine, and the degree of loss denotes the condition of the cylinder bore and piston rings.

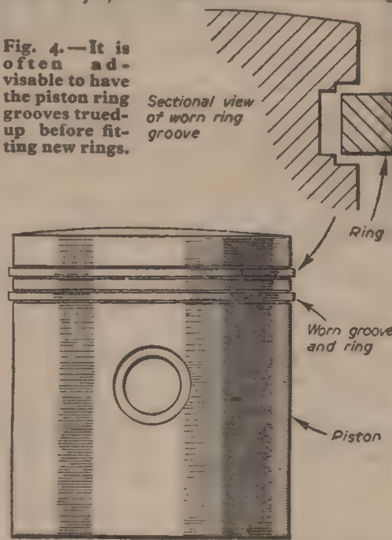
REBORING OR RE-RINGING

Where the bore and rings are considerably worn there are two alternatives; one is a rebore, whilst the other is the fitting of special oil control rings. Where the overhaul is carried out by a garage, a rebore is preferable for many engines require the same dis-assembly for either a rebore or re-ringing, and the only additional charge is for regrinding the bores and for the replacement pistons. The second alternative is highly commended to the owner who carries out his own repairs, for these special rings are self-adjusting to a considerable cylinder ovality and are really effective in restoring lost compression and in reducing oil consumption. To gain the full benefit of these special rings it is advisable to have the piston ring grooves turned and fitted with the rings at the manufacturers' service depot. This is necessary as in all probability the grooves have worn, as shown in Fig. 4, and the new rings will not ensure a perfect fit unless the grooves are trued-up. Also the ridge at the top of the cylinder bores will have to be removed unless special cut-away or stepped top rings are fitted to provide clearance. Incidentally, a point often overlooked after the fitting of new rings is the desirability of also replacing the oil filter, for the new rings in bedding-down inevitably remove minute particles of metal in the process, and a filter that is partially blocked with sediment, etc., will in all probability by-pass the metal contaminations in the oil.

RENEWING VALVE SPRINGS

A falling off of the performance at fairly high speed levels is often due to the weakening of the valve springs, which allow valve bounce and delayed closing to occur. Generally speaking, it is a good rule to renew the valve springs at every second decarbonisation or at intervals of between 25,0000 and 30,000 miles. The first method is preferable as the cylinder head is removed for decarbonising

Fig. 4.—It is often advisable to have the piston ring grooves trued-up before fitting new rings.



and no additional dis-assembly is required. The exhaust valves should be renewed when they have been subjected to considerable refacing, for the edges will have been so reduced that it may become incandescent during running, thus promoting early pitting and inducing pre-ignition. Fig. 5 shows a comparison between a new valve and one that has been considerably refaced.

WEAK CONTACT-BREAKER SPRING

An obscure cause of bad performance at elevated speed levels is a weak contact-breaker

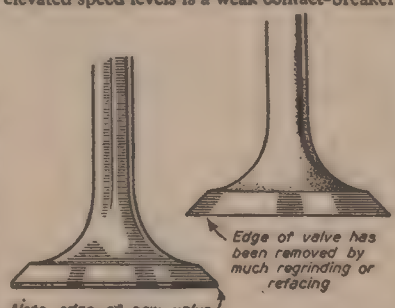


Fig. 5.—When the edge of the head of the exhaust valve has been reduced to less than 1/32in. by regrinding, etc., it must be renewed to avoid burning, pre-ignition and pocketing within the port.

spring, which allows insufficient dwell of the points to build up a satisfactory magnetic field within the coil. Troubles of this nature are usually indicated by a "flat" feeling of the engine above a certain speed when further acceleration is not possible. Often, it is also accompanied by misfiring and cutting-out. The metal of the contact-breaker spring is quite malleable, and by bending it carefully outwards the lost tension is easily restored.

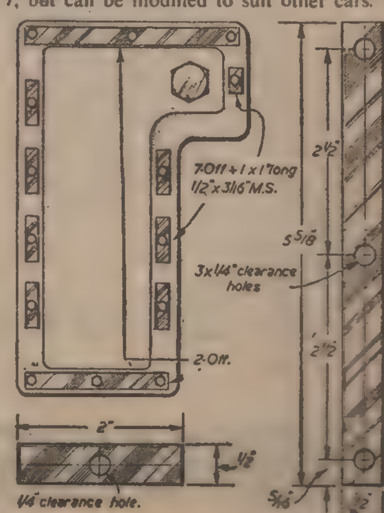
Among the principal faults to look for in the ignition and petrol system are a partially blocked main jet, an ineffective accelerator pump, a faulty petrol pump, including defective valves, a stretched, distorted or torn diaphragm, a worn linkage or push-rod, incorrectly adjusted or dirty contact-breaker and plug points, or sparking plugs that are not suited to performance range of the car. In this respect modern cars with their higher compression ratios require a "harder" or more heat resistant plug than older cars, otherwise pre-ignition and "drying-up" will occur at elevated speed levels. Conversely, an older car with lower compression ratios and lower peak ignition temperatures will require a softer plug, otherwise oiling-up troubles will occur during the lower speed ranges.

CHOKED MUFFLER

A choked exhaust silencer by causing excessive back-pressure can seriously reduce the performance. This trouble is more likely to occur with an engine that has a fairly heavy oil consumption, for the baffle holes within the silencer gradually become choked with the accumulation of carbonaceous oily deposits. When this occurs, the exhaust note has a muffled and woolly sound and is accompanied by overheating and excessive fuel consumption. The oil deposits can be removed from the silencer by removing, then blocking one end up and filling with a strong hot caustic soda solution, care being taken to avoid splashing the hands, etc. After leaving the solution within the silencer for approximately 30 minutes, drain it off and follow with several flushings of clean water.

SUMP LEAK IN AUSTIN 7

ON Austin 7 and other cars where the sump cover is made of thin-gauge sheet steel, the sump joint is not always completely oil-tight, due to the metal "giving" under the sump cover bolts, although ordinary washers are fitted. The remedy consists in fitting washers made of ½ in. x 3/16 in. flat mild steel, as shown in the sketch. The three holes at each end can be covered by one strip of the steel. Dimensions given apply to the 1937 Austin 7, but can be modified to suit other cars.



TRACE THAT RATTLE

● *Ways to cure body and suspension noises, plus advice on keeping engine fumes out of the car*

ON older cars the shock absorbers are often the cause of irregular noises when the car is in motion: the usual symptoms are dull, bumping noises, which almost invariably indicate that the rubber mounting bushes are worn. As the springs flex, the bolts securing the shock absorbers to the chassis are able to move up and down slightly without actuating the shock absorber arm. Further movement brings the bolt in sharp contact with the inside of the bush, and it is this which causes the noise.

Fig. 1 shows, in an exaggerated form, how the bush wears and allows the bolt to move. The obvious remedy is the renewal of the bushes. A temporary expedient consists of fitting a sleeve over the bolt so as to take up the play between the bolt and the rubber bush. The sleeve may consist of a length of tinplate wrapped round the bolt as in Fig. 1.

GLAZED SHOCK ABSORBER DISCS

With friction-type shock absorbers noises and squeaks may occur although the mounting bushes are quite in order. These noises are caused by the friction discs becoming glazed by the constant movement to which they are subjected. A little kerosene squirted on the edges of the discs will stop the noise temporarily.

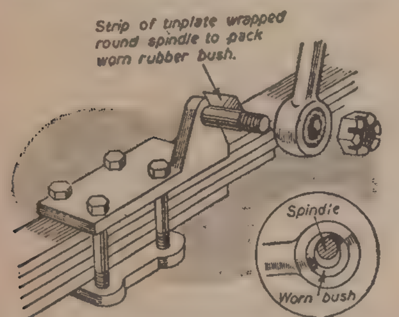


Fig. 1.—Worn bush which allows the bolt securing the shock absorber to the chassis to move can be a source of noise.

It must be understood, however, that this treatment is unlikely to effect a permanent cure. Also the kerosene may reduce the effective resistance of the shock absorber. Therefore, at the first opportunity the offending component should be dismantled and the fibre discs rubbed down with coarse emery paper, or a file, until no glazed patches remain.

DRUMMING NOISES

There is a type of noise peculiar to metal-bodied cars which takes the form of a drumming sound. It is caused by the vibration of the metal panelling, particularly the roof, in unison with the vibration of the engine. Very often a considerable improvement can be effected by removing the trimming from the inside of the roof and wedging a number of felt pads between the cross members of the roof and panelling. Sheets of cotton wool or light felt glued to the panelling itself will also provide a certain measure of sound insulation.

SQUEAKS WHEN CORNERING

Another squeaking noise, which comes from outside the car, but which can clearly be heard when driving, is produced only when the car is cornering. It is often produced by loose wheel spokes. The fact that it happens when cornering provides the clue to its source. This is usually confirmed on examining the offending wheel or wheels by signs of rust around the spoke nipples. The slight movement of the loose spokes wears away the enamel at these points and allows rust to form. The obvious cure is to tension up the spokes, taking care at the same time to maintain the alignment of the wheel.

Squeaks which appear to come from the instrument panel may be due to friction between the bonnet and tape round the edge of the scuttle. Rubbing the tape with soap is all that is needed to stop the noise. It must not be forgotten, also, that tools under the bonnet are likely to cause rattles unless carefully packed.

ENGINE FUMES

Engine fumes are usually associated with an engine which needs reboring. The burnt gases blow past the pistons and escape from the breather. A fume consumer will often provide a simple cure.

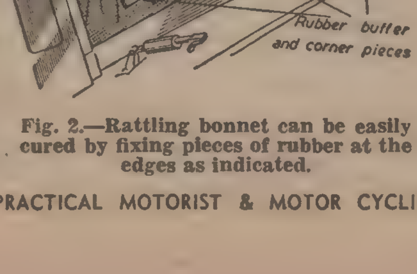


Fig. 2.—Rattling bonnet can be easily cured by fixing pieces of rubber at the edges as indicated.

Sometimes, however, fumes make their way into the interior of the car even when the engine is in good condition. The most likely causes of these fumes are either burning oil from the exterior of the engine or leaks in the exhaust system. An engine which has been allowed to get dirty and covered with oil will invariably smell when hot.

Two sources of burning oil fumes are frequently encountered. One is a faulty cylinder head cover washer which allows oil to seep on to the exhaust manifold, where it burns; the other is caused by oil from the air filter running down on the manifold.

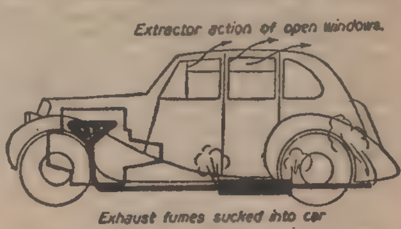


Fig. 3.—Open windows will often induce fumes from a faulty exhaust system into car.

Leaks in the exhaust system may occur at the flange joint between the manifold and exhaust pipe, and can easily be detected by a hissing noise from the joint. If this flange is loose or the gasket broken the escaping gases will immediately find their way into the body of the car. A less obvious source of fumes is the muffler joints themselves. It might be assumed that the gases would be carried away by the motion of the car, but often this is not so (Fig. 3).

Usually the fumes are caused by nothing more serious than the muffler clips having worked loose, but gases may also enter due to the tail pipe being too short.

Check Your Gearbox

● *Locating faults in plain and synchromesh gearboxes, with instructions for overhaul*

A USEFUL indication of the state of the gearbox can be gained by examining the oil drained from it. While it is not unusual to find chips from the gear teeth in the older type of gearbox should the gears have been "crashed," a more important symptom is a fine metallic powder in the oil, which frequently indicates that a bearing has broken down.

If the noise is apparent when the vehicle is stationary, wear is indicated on the constant-mesh gears. Alternatively worn mainshaft or slack layshaft bearings may be the cause. If the noise emanates from the constant-mesh gears, a new set of gears is essential. It is preferable to fit new parts, although very frequently gears from another gearbox will prove quiet when put into service with a different combination of gears even though they may have been noisy in their original box.

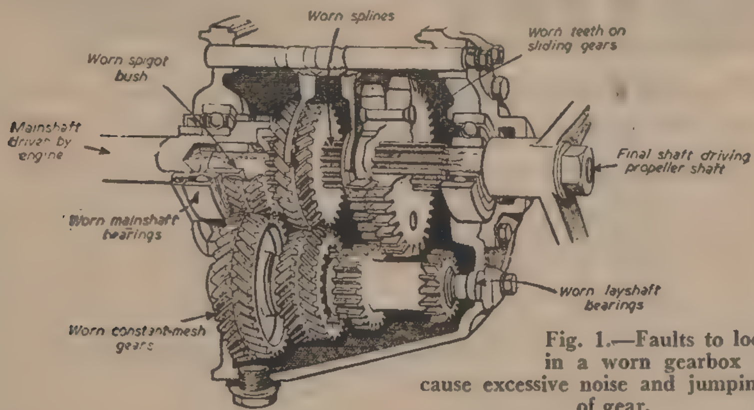


Fig. 1.—Faults to look for in a worn gearbox which cause excessive noise and jumping out of gear.

It is advisable to determine which parts are worn before dismantling the box; when it is removed it undoubtedly requires an experienced eye to detect, for instance, the small amount of wear in a bearing sufficient to cause noisy operation. Fig. 1 illustrates points to be looked for.

WORN WHEEL BEARINGS

A noisy gearbox when the car is running may be due simply to worn gears, or chipped or broken teeth due to bad gear changing. Usually the bearings will also be worn, and this wear in itself will be quite sufficient to cause undue noise, although the gears themselves may be in reasonably good condition. The spigot bearing in the mainshaft is a common cause of this defect.

Layshaft gears are often of the hollow type, running on a fixed shaft. When roller bearings are used, renewal is seldom difficult. It is not unusual, however, for the shaft to be fitted with bronze bushes. While these bushes can be pressed out and renewed, an expanding reamer is nearly always essential in order to obtain a good running fit on reassembly. In this case it is best to leave the work of renewing bushes in the hands of a capable repairer.

Noise is sometimes due to endplay of the layshaft. In some cases provision is made for adjustment by means of thrust studs or screws as shown in Fig. 2. After slackening the locknut, the set-screw should be tightened until it is felt to "bite." It should then be screwed back $\frac{1}{8}$ of a turn and the locknut retightened.

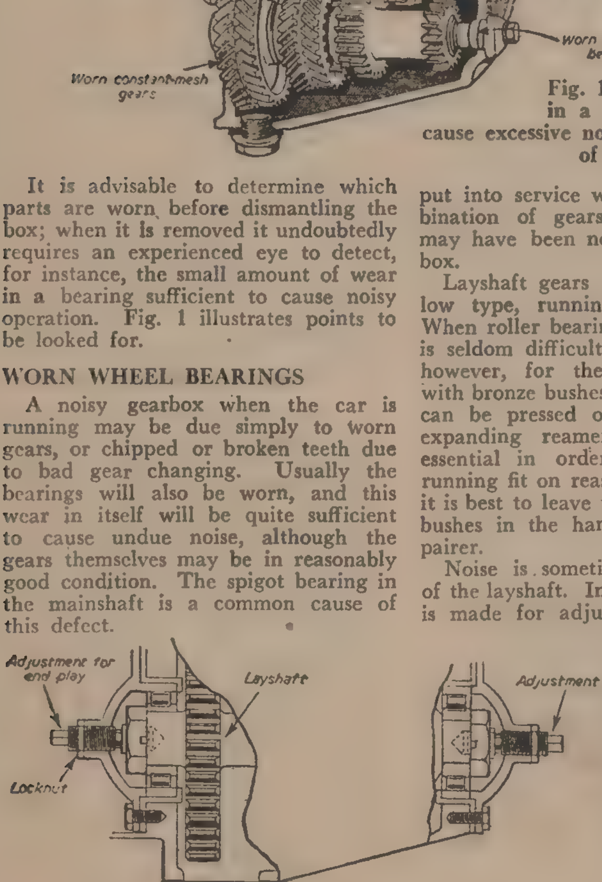


Fig. 2.—End adjustment of the layshaft may be provided as shown on right. After slacking the nut, tighten the set-screw.

SELECTOR MECHANISM

A not unusual fault is for a gear to jump out of engagement. Often the trouble is due to wear on the gear teeth, which tends to force the gear wheels apart. The trouble will be aggravated if the selector rods or forks are worn, or if the spring-loaded balls which locate the selectors fail to seat properly. This may be due either to weak or broken springs or to wear in the slots in which the balls seat.

Fig. 3. illustrates some selector troubles. When the trouble is due to wear in the slot of the selector rod, judicious deepening of the slot by grinding or stoning will often cure it. If a weak selector spring is the cause, a new one should be fitted. In some cases the spring controlling the reverse gear is stronger than that provided for the forward speeds; try fitting a reverse spring to the forward speeds.

Wear in the selector bars which control the movements of the sliding gears may take place at the sides of the slot, with which the gear lever engages, or in the forks and the groove in the boss of the sliding wheel. It is possible to remedy this by fitting new parts, or by building up the worn sections either by welding or, in certain cases, by riveting on suitably shaped packing. Slight backlash seldom causes trouble when a ball-change is fitted. When a gate-change is used, however, the gear lever may butt against the end of one slot before the gears mesh correctly. By filing the slot (as in Fig. 3) the gear lever will move the selector farther in the required direction, so that the gears are fully meshed. Jumping out of gear may

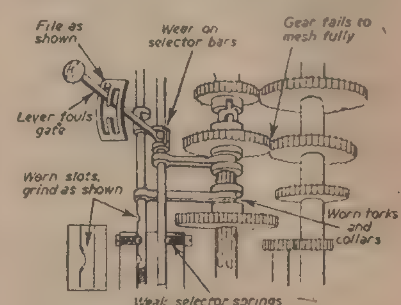


Fig. 3.—Selector troubles which contribute to jumping out of gear. Remedies indicated are dealt with in the text. Although for simplicity's sake an old-type box is shown, the points apply equally to a modern assembly.

occur when the box is mounted separately from the engine, and is connected by a short shaft, if the gearbox is not correctly aligned with the crankshaft.

OIL LEAKS

Oil leaks can usually be rectified without difficulty when the box is dismantled. They are usually due either to badly fitting flanges or to faulty oil-retaining devices. Often a bearing which is rotating in its housing will cause an oil leak.

Having diagnosed the faults that exist in the box, the question of overhaul arises. Generally speaking, the earlier plain type of gearbox is by far the easiest to overhaul. More recent synchromesh designs are considerably more complex, while the pre-selector or self-changing box should be tackled only by an experienced mechanic.

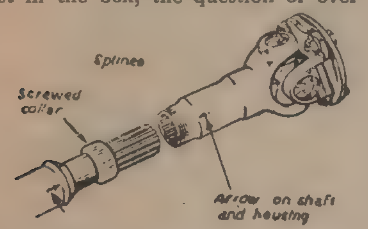


Fig. 4.—If a Hardy-Spicer propeller shaft is uncoupled as shown, the arrows on shaft and housing must be in line on reassembly.

GEARBOX REMOVAL

The removal of the gearbox from the car will depend on the design. The simplest proposition is the separate gearbox connected to the engine by a short cardan shaft. When the gearbox is attached to the clutch housing it may be necessary either to disconnect the gearbox from the bell housing, or to remove the housing complete with the gearbox, according to make of car.

It is often necessary to support the gearbox by means of a jack while disconnecting it from the engine, subsequently either lifting it out of the chassis or dropping it downward. It will, of course, be necessary to disconnect the universal joint, and the torque tube attachment, when fitted, from the rear of the gearbox.

When a Hardy-Spicer universal joint is used it is not always necessary to uncouple the joint at the flange bolts before removing the box. On unscrewing a collar at the end of the shaft the splined end of the propeller shaft can often be pulled out of the splines in the joint on removing the box. When the shaft is replaced, the splines should be engaged so that the arrow on the shaft registers with the arrow on the casing, as shown in Fig. 4.

In the majority of gearboxes the design is such that the bearings can be forced endways out of their housing, leaving the shafts free to be manoeuvred and removed through the top opening. The selector mechanism usually comes away with the top of the gearbox. In some cases, however, the selector rods are left in place on removing the gearbox lid. When this is the case care should be taken to remove all external locking parts. The selector locking springs and balls may have to be taken out, for instance, after unscrewing the plugs, before the lid is lifted.

LAYSHAFT

When the gears are exposed it is usually necessary to begin work on the layshaft. In most cases the speedometer driving-gear must be removed before commencing operations, while the couplings on mainshaft and final shaft must be detached in most cases. When the layshaft is carried in ball bearings, the end covers which enclose the bearings must be unscrewed. It is usually possible to tap the shaft gently in an endwise direction from each end alternately; if carefully carried out this procedure should allow the bearings to be pressed out of their housings. Inspection of the bearings will reveal whether this procedure is likely to be successful, since it will obviously be useless to drive a bearing up against the flange of its housing.

The work is somewhat easier when the layshaft is of the hollow type, since the shaft on which it runs can normally be driven out of the box after removal of a fixing stud or bolt passing through one end of the shaft. Extraction of a shaft of this type is often facilitated by inserting a bolt in a hole tapped for this purpose in the end of the shaft. As the shaft is removed the gear assembly will fall into the bottom of the box. The primary shaft, driven by the clutch, and the final shaft, which drives the propeller shaft, form two sections, the final shaft spigoting into the primary shaft and running in either a plain, ball or roller bearing.

PRIMARY SHAFT

The primary shaft is usually carried in a large double-ball or roller bearing. In most cases on removal of the bearing cover the bearings and constant-mesh pinion can be withdrawn without great difficulty. The final shaft can then be removed, endwise, into the box from the rear, and the shaft raised at one end and withdrawn through the top of the box; it may be necessary to slide the gears off the splines, removing them separately.

In some cases, when the gearbox is bolted to the clutch housing, the gear clusters may come away with the clutch housing when this is parted from the gearbox.

REMOVING RACES

Care must be taken when removing the bearings not to apply unnecessary force. Any retaining spring clips fitted must be removed. If the bearings have to be driven out the force must be applied squarely, and a proper extractor used if possible; when tapping out a race a piece of tubing of suitable diameter often proves useful, as shown in Fig. 5. Usually, the outer race is a tight fit in its housing, the inner race being a push fit on the shaft. When a bearing breaks down, the outer race sometimes rotates in its housing. It may be possible, when only very slight slackness exists, to tin the outside of the race with solder in order to restore a tight fit in the housing. Usually, however, it is advisable to have the housing turned out to a specific oversize and to fit an oversize bearing.

Reassembling the gearbox will be undertaken in the reverse order to dismantling. Care should be taken to replace all shims, bearing-retaining spring-clips, and oil retainers correctly.

SYNCHROMESH GEARBOXES

A typical synchromesh layout is that shown in Fig. 6, where it will be seen that double-helical gears are employed, and that synchromesh is provided in second, third and top ratios. The constant mesh gears, second gears B and third gears C are permanently in mesh, but whereas the constant mesh gears are fixed on a primary shaft and counterbody, likewise all the other counterbody gears, the second and third mainshaft gears are free to revolve on the mainshaft, being bushed internally and engaged by means of dogs formed on the gears.

In Fig. 7 is shown the first mainshaft gear splined to slide on the sleeve, which in turn is splined to the mainshaft. Machined in the front end of the sleeve is the outer cone which contacts with the second mainshaft gear when about to engage second gear, the internal dogs on the first speed subsequently locking the second gear to the mainshaft. The synchronising of the gear speeds before engagement is, of course, provided by the cones of the respective gears, and in order to provide sufficient pressure when engaging, the sleeve has a series of spring-loaded balls which engage in a groove cut in the inside of the mainshaft gear. Subsequently, the synchromesh action is governed by both the actual fit of the cones and also the amount of tension exerted by the springs in the synchromesh sleeve.

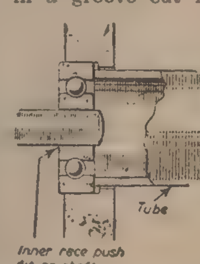


Fig. 5. — When driving ball-races into or out of their housing it is advisable to use a length of tubing as shown.

THIRD AND TOP GEARS

Third and top synchromesh is provided by the assembly shown in Fig. 8. The outer ring controlled in movement by the change-speed lever has internal dogs formed in both edges and is splined and spring-loaded on to the centre boss. The latter is splined and free to slide on the mainshaft so that,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on engaging the dogs on third gear and constant pinion for the third and top gear respectively, a positive drive is provided. The first gears are straight cut, and orthodox methods of engagement are employed.

From the aspect of overhauling there are several points worthy of special mention to those interested in a major job of this kind, and even to those who are experienced in general mechanical work.

Usually, removal of the gearbox from the chassis provides little difficulty. With unit three-point suspension and an open propeller shaft the front universal joint has to be uncoupled, also the rear gearbox mounting and then the clutch housing bolts, taking care meanwhile to support the back end of the engine. It may then perhaps be necessary to lift the engine at the rear before drawing off the complete gearbox, so as to clear the centre cross member. Otherwise, if the engine is mounted at four points, the gearbox will be free for withdrawal after dropping the front universal joint and disconnecting the clutch housing.

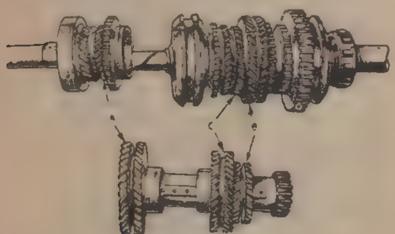


Fig. 6.—Typical synchromesh layout in which double helical gears are used.

DISMANTLING THE BOX

When the box is on the bench, either the primary shaft or complete mainshaft assembly is first withdrawn complete with bearings. The mainshaft will be spigoted into the primary shaft with either bush or roller taking radial load. Thrust in the spigot bearing may be taken by a ball or thrust pad, and when separating the two shafts care should be taken to prevent it from falling inside the box and becoming lost. The layshaft may be flanged or dowelled to one end of the gearbox shell, and its withdrawal will then release the counterbody and gears which, it will be noted, are a free sliding fit on the splines, except first gear, which is integral with the counterbody.

In replacing worn gears, it is advisable to renew them in pairs, as replacement of one pair invariably tends to create noise and cause accelerated wear of the new one. Should the bushes in second and third mainshaft gear be worn it will be necessary to send them to a specialist for rebushing.

FITTING NEW COUNTERBODY

In fitting up the counterbody with a new gear or perhaps renewing the counterbody itself, the new part will probably require easing down slightly on the splines to give free longitudinal movement. This can be done by smearing a little fine grinding compound on to the parts concerned and working them together until free, when all traces of compound should be washed away. Similar treatment may be given to the first mainshaft gear if occasion should demand replacement.

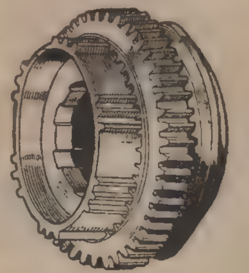


Fig. 7.—First mainshaft gear splined to slide on the synchronising sleeve.

The synchromesh adjustment requires considerable care. The setting of the spring tension is, of course, governed by the strength of the springs, and if they appear to have collapsed they should be replaced. However, if before dismantling for overhaul the gear lever "fell" into gear in a "sloppy" manner, there being little resistance when moving the lever out of neutral and into gear, it can safely be assumed that the spring tension can be increased. Should the springs on examination appear to be in reasonable condition, their resistance can be increased by packing out with small shims. This should not be overdone, or the gear will be stiff and difficult to engage.

Incidentally, the synchro spring tension of second gear should be stronger than third and top, owing to the larger step in ratio between second and third. Reassembling the springs and balls will require some patience, but a little grease applied judiciously will help.

GRINDING-IN CONES

The next step is to ensure a perfect fit of the cones. This is most effectively done by grinding the cones together in pairs, using fine grinding compound thinned down with a little light oil.

Dealing with top first, mount the mainshaft in a vice with cone in position on the shaft and smear a little compound on the cone of the constant pinion before placing the pinion shaft on the spigot. The pinion shaft may then be worked by hand, similar to grinding-in valves, until the cones show a perfectly even contact surface. The second and third cones are treated in the same way, mounting the cones together on the mainshaft so as to obtain absolute accuracy.

REFITTING INTO BOX

Having overhauled the synchro and fitted any new gears which may have been necessary, assembly into the gearbox shell is reasonably straightforward. The layshaft and counterbody assembly are the first to be refitted and if a thrust washer is provided for the latter, care should be taken in giving the correct amount of end float. The mainshaft assembly follows, but there may be some difficulty in meshing the gears with those of the counterbody, which will need sliding into correct position to locate with the former. This is most important, as with double-helical gears it is easily possible to only partly mesh two gears. This may have disastrous results, such as tooth breakage. Probably the mainshaft will almost obscure the counterbody assembly when in position, but a mirror or flashlamp will be helpful in making certain that the gears are properly meshed.

Finally, the primary shaft is refitted, taking care of its spigot bearing and thrust ball or pad. The usual permissible mainshaft float is .004in., this being determined in assembly by the thickness of thrust pad or diameter of ball.

It is sound practice to renew all oil retainers and paper flange washers which invariably become damaged in dismantling, the cost of renewal being very small as compared with that of dismantling the box again should any leakage develop later.

ADJUSTMENT

Once the gearbox is reassembled there is, of course, no external adjustment for the synchromesh, but it is, nevertheless, impossible for it to be effective if, after declutching, there is the slightest drag from the clutch plates which are infinitely more powerful than the action of the synchro cones. Drag from the clutch is usually most noticeable when engaging first gear from rest, when the still revolving countershaft gear will strike and grate against the stationary mainshaft gear.

Many clutches of modern design have no internal adjustment that can be made without dismantling the unit, but there is always an adjustment between clutch pedal and operating arm, so that, if there is too much lost movement in the travel of the pedal, it can

Fig. 8.—Third and top gear operating sleeve assembly.

be taken up by means of this adjustment, thus giving the clutch operation greater movement and reducing drag on the driven plate. The clutch adjustment should always be carefully maintained to prevent wear on the synchro and damage to the first gears.

It is equally important for the driver of the car with a synchromesh gearbox to remember that he must not snatch the gear lever into position, but must do so with a slow, firm and progressive movement, thus allowing time for the cones to pick up or reduce the speed of the engaging member.

MORRIS 8 OVERHAUL

Part 2. De-coking, checking bearings, pistons and rings, and tuning 1935 to 1939 models

SERIES 1, 2 & E

DECARBONISING should present no difficulties. Experience has shown, however, that time and trouble can sometimes be saved by bearing in mind one or two points. Beginning with equipment, in addition to the standard tool kit, a valve-spring compressor will be required, together with a suction valve-grinding tool, and a special tool for locating the cylinder head.

DISMANTLING

The first step on earlier models will be to remove the bonnet. Do not remove the screws holding the rear hinge plate, as it will be difficult to replace the nuts behind the scuttle, without removing the sloping board behind the instrument panel. Instead remove the two bolts through the rear ends of the bonnet stays, so that the top of the radiator can be eased gently forward until the front end of the bonnet hinge is clear of its socket.

While the radiator is draining, disconnect the battery and remove the air intake silencer. Disconnect the outlet hose from the cylinder head and release the tension on the fan belt (Fig. 7). Note the generator leads before disconnecting them and remove the generator after unscrewing the bolts which attach the adjustable portion of the generator cradle to the bracket on the cylinder head.

After disconnecting the sparking plug leads, and the high-tension and low-tension lead from the distributor, remove the distributor as a unit by slackening the set-screw which locks the timing lever to the head, making a note, when the quadrant is graduated, of its position in relation to the arrow mark on the head. On no account slacken the clamping bolt attaching this quadrant to the distributor, or the timing will be disturbed. It is well to remove the sparking plugs, to eliminate any risk of fractured insulators should a spanner slip.

SLACKENING CYLINDER-HEAD NUTS

On Series E models detach the carburetter throttle control from the carburetter. The 13 cylinder-head nuts can then be slackened half a turn at a time in rotation, and the cylinder head lifted. The joint can be broken by replacing the sparking plugs and turning the engine sharply with the starting handle. After lifting the head, withdraw the gasket carefully, so that it is not bent or damaged, as it may be possible to use it again.

Carbon deposit can then be scraped from the cylinder head and piston in the usual manner, taking care not to damage the piston crowns. When everything is thoroughly clean, the valves can be removed. At this stage the best plan with earlier models is to jack up the front axle as high as possible and rest it on bricks or wooden blocks, as this enables the cotters and tappets to be more conveniently reached. On the Series E model, it will be necessary to remove the nearside front wheel; this will reveal an inspection plate on the inner surface of the wing (Fig. 8). Thoroughly clean away all deposits of mud, and detach the plate, when the carburettor and manifold, and the valve chamber will be accessible.

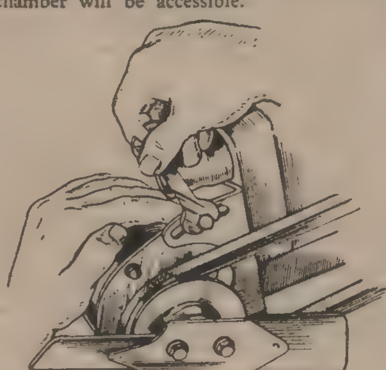


Fig. 7. — Generator belt tension is adjusted by slackening the nut shown and swinging the generator upward.

ACCESS TO VALVES

To work on the valves, it will be necessary to remove the inlet and exhaust manifolds. When detaching the valve cover plate, take care not to damage the gasket beneath it. Plug the two oil return holes in the valve chamber with rag, and compress the valve springs with a suitable tool. The best plan is to insert the claws in the lower coils of the spring, instead of under the collar. Thus, when the spring is compressed, the collar will be left in place, retaining the cotters; it can then be pushed up by hand, allowing the cotters to be removed comfortably. Each

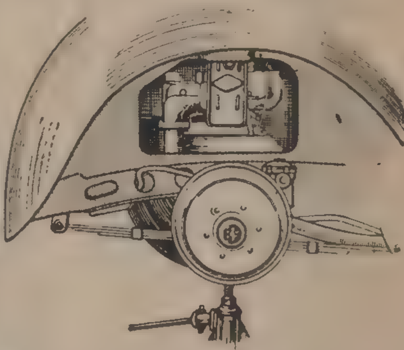


Fig. 8.—On the Series E "Eight" access to the carburetter, manifolds and valve chamber is simplified by removal of the inspection plate from the nearside wing, after taking off the wheel.

valve is numbered, so there is no difficulty in grinding it in on its correct seating. As there is no screwdriver slot on the later models, the suction valve grinding tool shown in Fig. 9 must be used.

When replacing the valves, fit the exhaust valves first, as there is slightly less space available around these.

VALVE CLEARANCES

The valve clearances should then be adjusted. The tappet clearance on the 1935 and Series 1 and 2 models should be .019in. when the engine is hot. As in this case the tappets will be adjusted with the engine cold, a clearance of .020in. should be allowed. On the E model, clearance should be .017" hot or .018" cold. A thin spanner is used to hold the flat on the head of the tappet while the lock-nut is slackened with a [illegible]in. spanner. The hexagonal tappet screw can then be turned with a third spanner, and held while the lock-nut is tightened.

Although the use of three spanners as described does not present any difficulties once the knack has been acquired, adjustment can be simplified by filing a strip of metal until it will just fit on the flats of an adjacent pair of tappets, thus preventing them from rotating, so that two spanners can be used, one on the lock-nut and the other on the tappet screw, (See Fig. 10.)

When replacing the cylinder head, it is

always wise to use a fresh gasket if there is the slightest doubt concerning the old one. Lower the head on to the gasket, and insert the special cylinder head locating tool right home into the distributor spindle tunnel. The best plan is to tighten down the cylinder head evenly, leaving off generator bracket and air

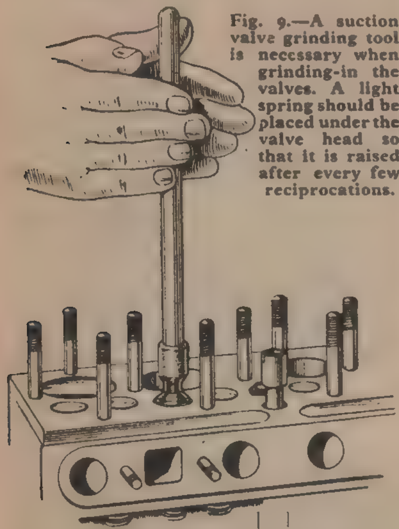


Fig. 9.—A suction valve grinding tool is necessary when grinding-in the valves. A light spring should be placed under the valve head so that it is raised after every few reciprocations.

silencer bracket. In earlier models it is best not to refit the horn at this stage. After firmly tightening the cylinder-head nuts, pulling down each a quarter of a turn in the order shown in Fig. 11, the special locating tool can be withdrawn and the distributor replaced.

Replace the manifolds, fit the hose connection, screw home the sparking plugs, and fill the radiator. Run the engine for a few minutes until it is warm, making sure that the fan belt is well clear of the crankshaft pulley. The cylinder head and manifold nuts can then be tightened down comfortably, before refitting generator, horn and air silencer.

BIG ENDS

If the engine is dismantled for reconditioning, it is essential to preserve the correct clearances. As the big-ends will not pass through the cylinders, the engine must be dismantled and assembled from below. On the 1935 Series 1 and 2 models, the connecting rods are directly lined with white metal, and are of the full-ring butted type, so that they must not be scraped in or fitted, nor must the bearing caps be filed to take up wear. No shims are used. The standard radial clearance is .0012in.

On the Series E engine the same rulings regarding filing the bearing caps or rods apply. In this case the bearings are in the form of renewable steel-backed shells, and if the white metal should run, the liners should be replaced by new ones. This again renders hand fitting superfluous.

CRANKSHAFT BEARING CLEARANCE

On all models the crankshaft bearings should have a standard radial clearance of .02 mm., plus or minus .01 mm., and are of the lined white metal steel-backed type, needing no fitting. End-float is controlled by the central main bearing, and should be between .4 mm. and .095 mm. Standard undersize bearings are available for reground crankshafts.

The pistons are of aluminium alloy, the earlier type having two compression rings, with one scraper ring above the gudgeon pin and one scraper on the skirt. It will be seen that the pistons are marked A, B, C, D and E. A is the standard size, +.001in., +.002in. or +.003in. B is .010in. or .015in. oversize and is intended for the first rebore. C is +.020in. or +.025in., D, +.030in. or .035in., and E, +.040in. or +.045in. The number of times that the engine has been rebored can thus be gauged.

PISTON RINGS

The piston rings should be a free but snug fit in their grooves. The gap should be .002in. to .006in. for the compression rings, whereas the scraper ring should have a gap of .012in. The piston clearance at the skirt should be .007in. The gudgeon pins, which are held in the split small-ends by pinch bolts, should be a push fit in the pistons when cold. The connecting rods should be movable, but should not swing freely. When reassembling, make sure that the pinch bolts are toward the offside of the engine.

If the timing chain is to be removed, the fan pulley must be withdrawn after unscrewing the starting dog. When the timing cover has been removed the timing chain sprockets will be exposed and can be withdrawn as an assembly after unscrewing the camshaft sprocket locating screw and lock washer. Ease the sprockets gently off their respective shafts with the chain in place.

TIMING CHAIN

Examination of the timing chain will show that it has two bright links, which correspond with a tooth marked "T" on each of the sprockets. Place the sprockets on the bench with the keyways on the top. This will bring the "T" marking at the top and bottom of the sprockets respectively. The chain should

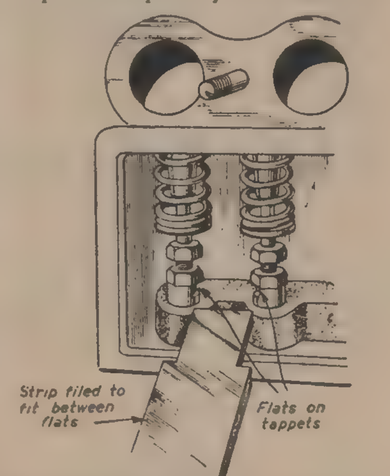


Fig. 10.—Instead of using three spanners when adjusting the tappets, the tappet can be prevented from rotating by filing a strip of metal until it will just fit between two adjacent flats, as shown. Two spanners can then be used on the lock-nut and tappet screw in the usual way.

then be fitted to the sprockets with the shortest portion, consisting of 12 links, at the top—that is to say, to the left when looking at the front of the engine.

The bright links on the chain will then match up with the "T" markings. As a final check on the timing after assembling the engine, set No. 1 or No. 4 cylinder inlet valve to the special clearance of .025in. when the engine is cold. Bring the corresponding piston to T.D.C. by locating the hole in the fan pulley flange in line with the timing mark on the timing chain cover. The valve should just open at this point if the timing is correct.

UNIVERSAL JOINTS

The later models have Hardy-Spicer needle-bearing universal joints, which are packed with grease, and consequently need no lubrication during the normal life of the car, apart from regular application of the oil gun to the sliding joint at the front end of the propeller shaft.

A point to be borne in mind is that if this sliding joint is dismantled, it must be re-assembled with the arrows registering, or the balance of the propeller shaft will be upset.

The early models were fitted with fabric disc joints which will occasionally need renewal. These joints are provided with a centring device, consisting of a plate attached to the gearbox or back axle spider, with a

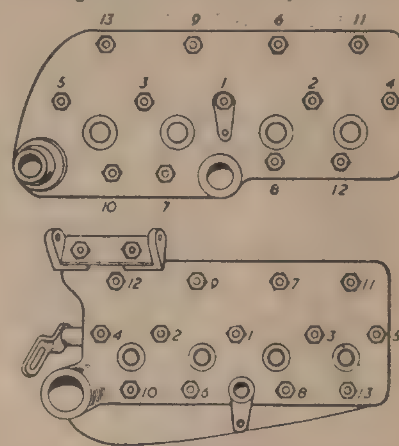


Fig. 11.—The cylinder-head nuts should be pulled down a quarter of a turn in rotation in the order indicated. The upper sketch shows the cylinder head fitted to the 1935 model and the Series 1 and 2 cars, while the lower is that used in the Series E engine.

central bearing which fits over a boss on the end of the propeller shaft. Care should be taken in reassembling the joints, since if the centring plate is fitted to the wrong holes in the fabric disc, so that it is rigidly fastened to the propeller shaft spider, the universal joint will only be centred on the propeller shaft, and will not necessarily be concentric with the back axle or gearbox shaft.

The correct method of assembly is as follows: The centring plate should have its projecting bearing facing the propeller shaft boss, as shown in Fig. 12. The fabric disc is attached to the propeller shaft through three of the six holes, and the centring plate and gearbox or rear axle spider are then bolted through the remaining holes. Do not overlook the distance washers, one on each side of the plate.

(To be continued)

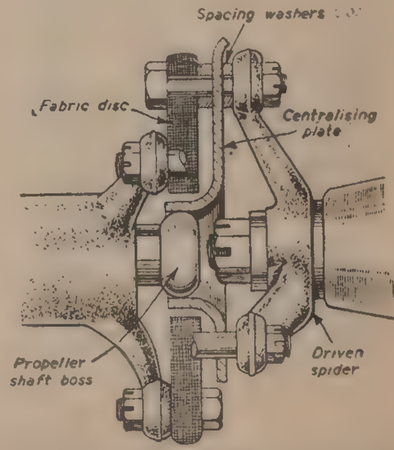


Fig. 12.—If the fabric universal joints fitted to 1935 models are dismantled they should be reassembled as shown. It is particularly important that the centring plate should be correctly fitted.

WINDOW WINDER REPAIRS

TROUBLE with window regulators usually originates from two causes, namely warping of the car body causing jamming of the glass and the entry of water which rusts the mechanism and makes it work stiffly. There is usually a certain amount of warning before the mechanism ceases to function entirely. The window first becomes stiff to wind up and down. Then it finally jams, or else something snaps and the operating handle goes round without moving the window.

REMOVING DOOR HANDLE

If a window is inclined to jam it is unless to force it, as this may strain or seriously damage the operating mechanism. Inspect the grooves in the frame in which the glass slides. Sometimes these are lined with felt and this may become rucked up. If so, it should be smoothed down and stuck in position with a little liquid glue.

Assuming there is no external cause for the window's failure to operate, the inside panel of the door should be removed. To do this, unscrew the handle of the window regulator. Some of the later pattern handles have no screw to hold them on. They contain a concealed catch and are sprung into position on the spindle. To remove this type of handle a special hook tool is used, as shown in Fig. 1. The tip of the tool is inserted in the hole at the back of the handle and pulled downwards. The handle will then spring off.

Next remove the lever which operates the door catch and any other fittings which may be mounted on the inside panel. Prise off the cloth or leather beading from round the edge of the door. This will reveal the heads of the nails or screws holding the panel in place. Extract these, and when the panel is prised off the interior mechanism of the door will be revealed, as in Fig. 2.

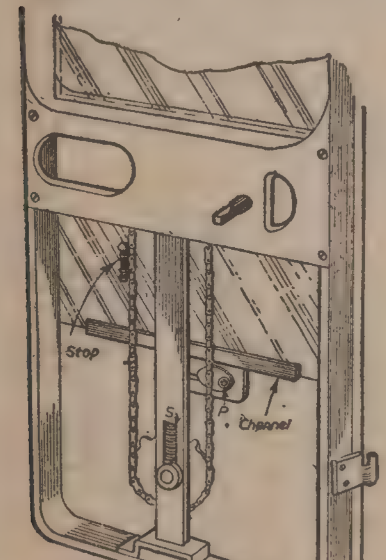


Fig. 2. — Door panel has been removed to show working of the winder mechanism.

On pre-war cars perhaps the two most popular types of winding mechanism are those which employ an endless chain passing over two sprockets (Fig. 2) and those which have a long lever geared to the handle by a spur wheel and pinion. Usually some device is incorporated to balance the weight of the glass so that it winds up as easily as it winds down. Often this consists of a large coil spring which winds itself up like the spring of a watch when the glass descends, and unwinds again as the glass goes up.

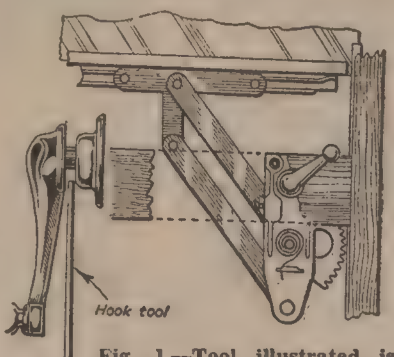


Fig. 1.—Tool illustrated is sometimes needed to remove spring-on window regulators. At right is Hobson lever-type regulator.

CHAIN-TYPE WINDOW WINDERS

With the chain type the most likely fault is that the chain has jumped off its sprockets. It is not a difficult matter to replace it, but before doing so it is advisable to examine the whole interior of the door. It may be that the glass is binding in the grooves of the frame, or some small article may have dropped inside the door and jammed in the chain or in the bottom of the grooves.

The chain itself will probably be twisted and must be straightened out and threaded over the sprockets. If there is a spring to balance the weight of the window, this will undoubtedly have unwound as soon as the chain jumped off. Therefore, before threading the chain over the top sprocket, the window handle should be replaced temporarily and turned round several times as though winding the window down. This will wind up the spring. The chain should then be jumped over the sprocket by threading it on to the sprocket and at the same time turning the handle. Of course, the amount of tension to be given to the spring before the chain is threaded on depends on the position of the glass. If the window is up, the spring need not be wound up so tightly.

● Having trouble with jamming windows? Here's how to fix them

Having replaced the chain, oil all the working parts, especially the chain, the spindle of the operating handle, and the gears. Work the window up and down several times to ensure that it is functioning properly and replace the door panel and fittings.

Sometimes when examining a faulty

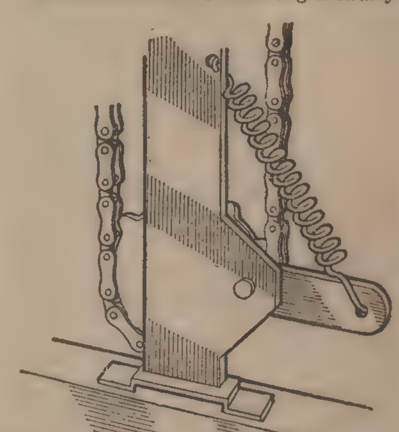


Fig. 3. — An older type of gear. Broken tension spring may cause winding chain to jump off sprockets.

window it is found that not only has the chain jumped off the sprockets but the little pin or stud (P in Fig. 2) carried by the chain, which engages in the slot in the channel piece attached to the bottom edge of the glass, has slipped out of the end of the slot. The stud should be fitted in the slot before the chain is replaced on the sprockets.

Admittedly, it is easier to thread the chain on when it is not connected to the glass, but if this is done it is usually difficult to replace the pin in the slot. This is because when the chain is in position on the sprockets

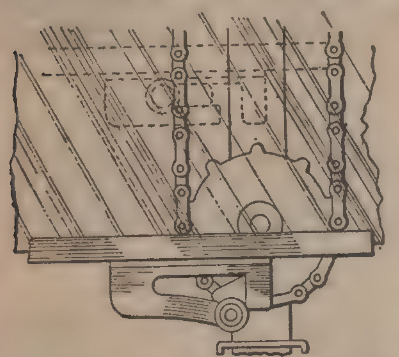


Fig. 4.—Cause of a window jamming may be that the pin has been forced out of its slot as illustrated.

it is always in tension, owing to the chain-tensioning spring S, which is fitted to the bottom sprocket, and this makes it hard to pull the chain sideways to reinsert the pin in the slot. Sometimes, the operation can be facilitated by unscrewing the frame of the winder mechanism where it is secured to the bottom rail of the door. It can then often be moved slightly to one side and the pin slipped in the slot in the channel.

In the case of old cars the reason why the chain jumps off the sprockets is often because the chain-tensioning spring has become weak or broken. This trouble is sometimes to be found where a chain tensioner of the type shown in Fig. 3 is used. The obvious remedy is a new spring.

RESULT OF OVERWINDING

Failure of the chain-type window regulator is not always due to the chain jumping off the sprockets. With some of the older types it is possible for the pin carried by the chain to become disengaged from the channel piece without the chain coming off. This is owing to the glass having jammed just before it reached the limit of its movement, and the operating handle having been forced round in an attempt to move it. Fig. 4 shows how this may occur. Obviously, the pin can only jump out when the window is near the top or bottom positions—that is, when the pin is located opposite the opening at the end of the slot. At any intermediate position, such as that shown by the dotted lines, the stud cannot jump out. When repairing a window in which the pin has jumped out of the slot in this way, it is best to examine the slot before refitting the stud. Quite likely it will be found to be strained and bent and should, therefore, be straightened.

A pair of strong pliers will often suffice to carry this out, but if it is difficult to manipulate them with the glass in position, then it will have to be lifted out of the door. To do this it will be necessary to remove the wooden sill or garnish rail along the bottom of the window, if this has not already been done.

On chain-operated window regulators a stop is usually provided at the limit of the downward movement of the glass so that there is no chance of the handle being turned too far. Such a stop is shown on the regulator in Fig. 2. It consists of a small screw carried by the chain. The position of the screw can be adjusted and is set when the regulator is installed. On the other hand, some types of regulator have no stop at all, but are designed so that the motion of the operating handle is continuous; thus, when the window is lowered right down continued turning of the handle causes it to rise again. In this case the slot in the channel piece is longer, so that the pin does not reach the end of the slot when half-way round the sprocket. It continues on and rises again as the chain passes round.

REFIXING CHANNEL TO GLASS

A mishap which is not confined to the chain-operated window, but which may occur with any type, is the detachment of the channel from the glass. If the window becomes jammed while being lowered and the handle is forced round, the channel piece may be wrenched off. The glass must then be removed from the door and the channel refixed in position. It will be found that the latter is insulated from the glass by a lining of rubber. In order to refix the channel securely it is best to renew the rubber. Rubber strip made specially for this purpose can be obtained from most motor accessories stores. It is placed between the glass and the channel as shown in Fig. 5, and the channel is then forced on. A hammer will be necessary to drive it on if it is

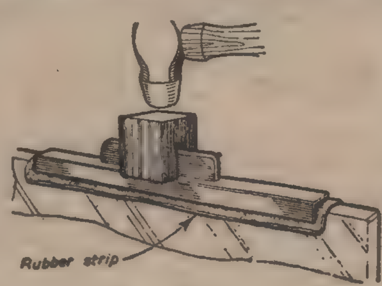


Fig. 5.—Refitting the channel piece to the bottom edge of the window glass. A block of wood is used to damp the hammer blows.

a tight fit—as it should be. The use of a block of hardwood fashioned as shown in the sketch will prevent the hammer from damaging the channel.

In order to ensure that the channel is replaced in exactly the same position as previously, the glass should be left uncleaned. The marks where it was previously fitted will then act as a guide. Care must be taken to see that the channel is fitted the same way round, since the flange forming the slot is usually offset. To be sure on this point the glass should be marked before removal from the door, and the channel also marked before it is detached from the chain or lever. Then so long as the units are replaced with the two marks positioned as before, there is no danger of wrong reassembly.

It is not the purpose of this article to give details of all the various types of window regulators, but mention should be made of the double chain types. These consist of two units similar to the one shown in Fig. 2. They are geared together and operated from one handle so that the window is lifted from two points, thus overcoming tilting of the glass.

LEVER-TYPE REGULATORS

The simplest type of lever regulator is that shown in Fig. 6. It is not suitable for very wide or heavy windows, but is particularly adapted for operating the driver's window in light cars. A single movement opens or closes the window.

With this type of regulator the weight of the glass is balanced by the tension spring so that it is as easy to

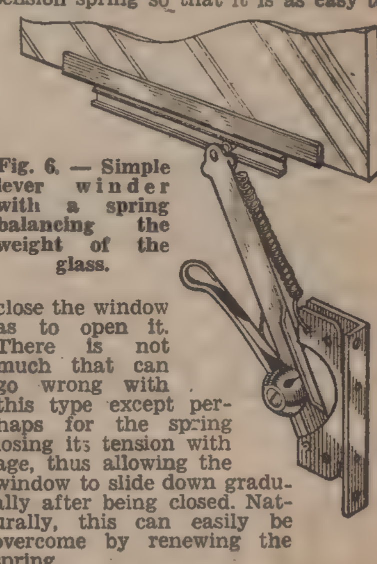


Fig. 6. — Simple lever winder with a spring balancing the weight of the glass.

close the window as to open it. There is not much that can go wrong with this type except perhaps for the spring losing its tension with age, thus allowing the window to slide down gradually after being closed. Naturally, this can easily be overcome by renewing the spring.

PREVENTING TILTING OF THE GLASS

Tilting of the window glass is particularly likely to occur with modern bodies of the streamlined or semi-streamlined types where one of the door pillars is sloping. The sloping pillar means that the window glass, when in any other position than closed, is virtually unsupported at the sloping edge. An ingenious and inexpensive device designed to prevent this is the Hobson regulator illustrated in Fig. 1. This is of the geared-lever pattern, but has two levers instead of the usual single lever. These are linked to the channel at the bottom of the glass by means of a T piece. As will be seen, the two levers with the T piece form a parallelogram, the T piece being held vertical whatever the position of the levers. Since the glass is supported by each arm of the T there is no tendency for it to tilt. A strong coil spring is incorporated in the window mechanism to counterbalance the weight of the glass.

Noisy Muffler?

● *Causes and cure of exhaust back-fires*

OWNERS of old cars are often troubled by explosions in the exhaust system when running downhill on a small throttle opening. Generally attributed to an unfired charge from one cylinder being ignited in the muffler, the explosions may be due to several basic causes. In most cases leaks in the exhaust system are the real reason, and if fumes are noticed when driving with all windows closed, it is a good indication that this is the cause.

When descending a hill using the engine as a brake, the throttle will be closed and a very small charge of mixture is admitted to the cylinders. The piston speed is high and the compression much less than in normal running, so the charge burns weakly and the flame may be extinguished by the depression caused by the descending piston. The partially burned charge passes to the exhaust system, and if it has air added via any leaks in the exhaust manifold joint, exhaust pipe, or muffler, it may start to burn again, giving a muffled "cough" or a loud bang according to the condition and design of the muffler.

LEAKS IN EXHAUST SYSTEM

The exhaust system should be checked for leaks, an easy matter if the car is put up on a ramp and the engine revved. The exhaust manifold and exhaust pipe joint gasket may be at fault, also any flexible portions of the exhaust pipe or acute bends where corrosion may have caused small holes. The muffler end plates often show leaks if they have been strained through taking the car over rough country.

The muffler usually receives less attention than almost any other component on the car, but it is not everlasting. Constructed of fairly thin metal (to save weight and expense), it is usually in poor condition on an old car. If a replacement can be obtained, it can make driving the car much more pleasant. A repair of this kind will result in reduction of fumes inside the car, more silent running, and freedom from exhaust back-fires.

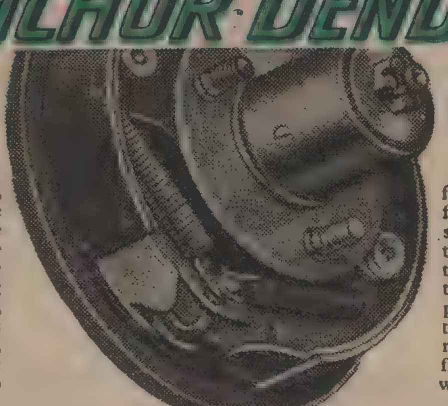
There is sometimes banging in the muffler at full throttle after a long, hot run at high speed. A sticking exhaust valve may be the cause, allowing a complete unburnt charge to reach the hot exhaust system. A plug which misfires intermittently may also be a cause of this full-throttle banging.

CARBURETTOR BACK-FIRES

Popping-back in the carburettor is sometimes confused with exhaust back-fires. It is not always, as is often believed, due to a weak mixture. The mixture will not weaken unless ill-advised fiddling with the jets has taken place. Poor scavenging, due to weak exhaust valve springs, excessive tappet clearance, a "masked" valve, a choked muffler, or a mud-plugged tail pipe may be the cause.

Single Anchor Bendix Brake

Dismantling, relining, reassembling, adjusting



WHEN dismantling the brake assembly, the vehicle is jacked up and the road wheel is removed. In the case of the front wheel it is necessary to remove the mud excluder before the drum can be removed. This is carried out by slackening off the pinch bolt securing it to the back plate, and after the removal of the two drum screws the drums may be taken off. It is, of course, necessary to have the handbrake off before the drums can be removed, and it is essential to secure the unjacked wheels to prevent movement of the vehicle.

The shoe assembly may now be dismantled. The two large springs attached to the anchor pin are first removed, followed by the spring attached to the actuating cam (Fig. 1). After the removal of the two small springs securing the assembly to the back plate, the shoes may be removed and the adjuster spring and toothed adjuster taken off the shoe web ends.

RELINING SHOES

The old linings are removed by punching out the rivets from the inside. Before fitting the new lining it is advisable to heat the brass rivets in a gas flame and to quench them in water in order to prevent their splitting during the fitting of the new lining. A fairly broad-faced punch is desirable to knock over the rivet. Fit the lining over the shoe and put the first rivet in a centre hole. Then insert the other rivets, working towards the edge from each side alternately.

REASSEMBLING BRAKE

Before commencing reassembly examine the shoe actuating cam. If there is a step on the face of the lever (Fig. 2), this should be ground off, as the step tends to foul the secondary shoe and prevent efficient action of the brake in reverse. Well grease the shoe actuating cam, the anchor pin, the operating lever, and the shoe web ends. Replace the operating lever over the anchor pin and fit the brake cable end upon it. Replace the shoe actuating cam in position over the anchor pin (Fig. 2)—in the case of the front brakes it can only be replaced by inserting the anchor pin

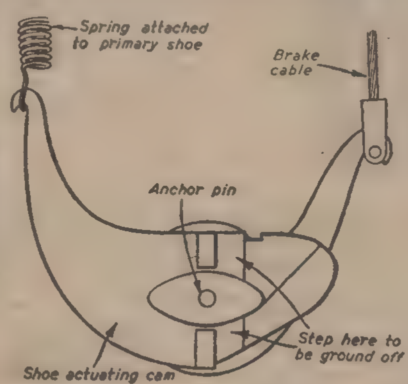


Fig. 2.—Shoe actuating mechanism.

through the rear of the cam slot and fitting over the anchor pin with a twisting motion. The toothed adjuster fits into the square recesses on the shoe web ends and is held in place by the spring. It should be inserted so that anti-clockwise rotation of the adjuster in the direction of rotation of the road wheel forces the shoes apart. The shoes are now fitted to the back plate by means of the two springs, and the actuating cam attached to the primary shoe by its spring. Finally the shoes are attached to the anchor pin by their springs, the red spring attaching to the primary shoe and the black spring attaching to the secondary shoe. The drums may now be replaced and screwed into position, followed by the mud excluders on the front wheels. Finally the road wheel is refitted.

CABLES

The brake cables may be adjusted by removing split pins and clevis pins attaching them to the cross-shaft. After the removal of the cable ends from the cross-shaft all the shoes are set tight in the drums by means of the adjusters. The cable length is adjusted by screwing the jaw end down the thread until the clevis pins can just be inserted on the jaw end on the cross-shaft without undue straining. The cables are then secured by the split pins. The brake shoe adjusters are now slackened off to the required braking efficiency and the brakes are balanced, if necessary, by road testing and further manipulation of the toothed adjusters.

Should a cable ever require replacement, the old cable is unbolted from the back plate after the shoe assembly has been dismantled and the jaw disconnected from the cross-shaft. On removing the bolt from the abutment bracket the old cable may be detached complete. The replacement cable is fitted in the reverse order. After fitting a fresh cable the lengths of the four cables will have to be adjusted as indicated above.

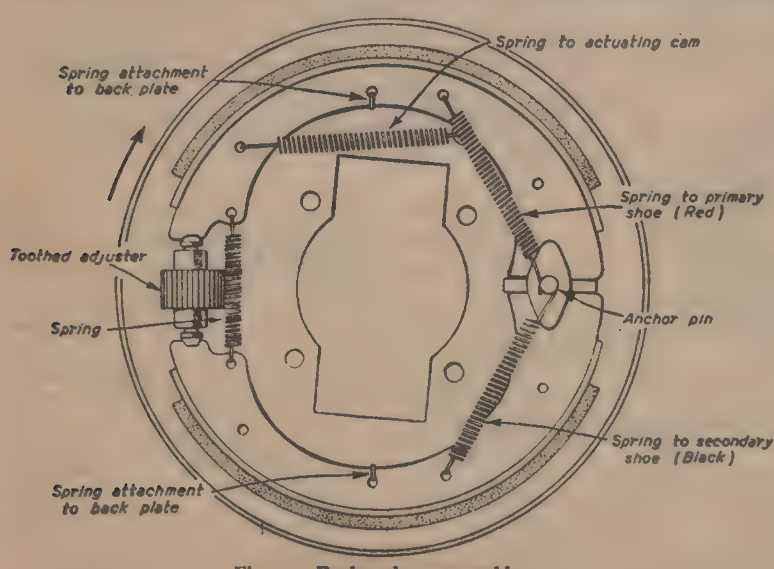
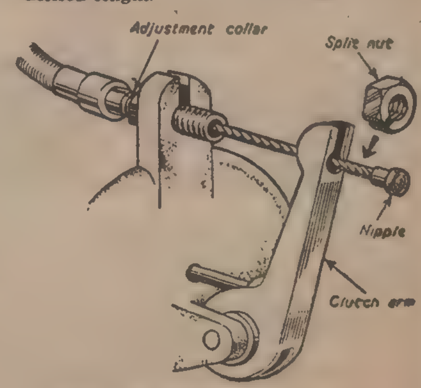


Fig. 1.—Brake shoe assembly.

Inner Cable Renovation

MANY motor cycle and car drivers have found at some time or other that an inner cable has stretched, and that the end of the adjustment collar has been reached.

A simple remedy for this is to disconnect the arm or control at the nipple end and insert a nut or washer, with a hacksaw cut through one side, on to the cable; the arm is then replaced and the cable adjusted to its desired length.



Method of renovating an inner cable.

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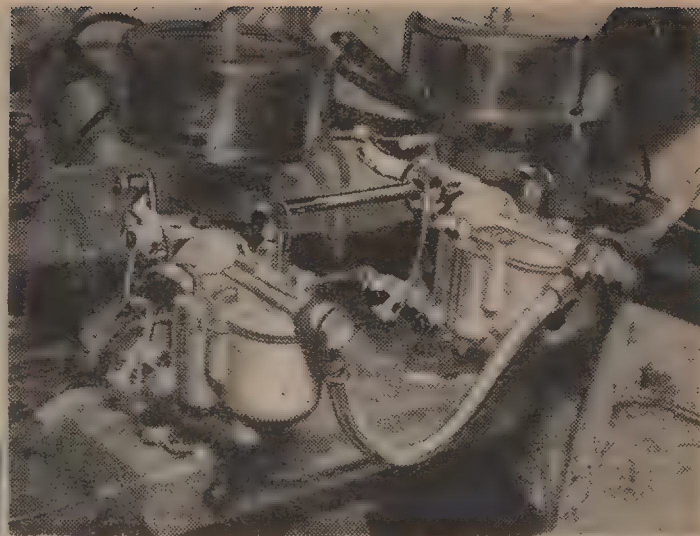

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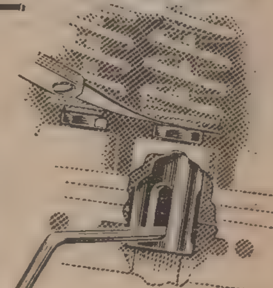

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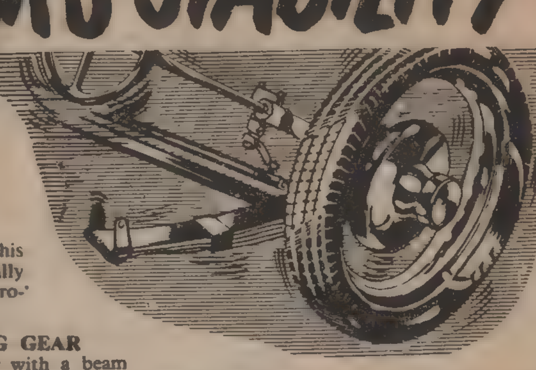


• *Simple adjustments will give you a safer, smoother ride*

UNDOUBTEDLY, one of the greatest advances of chassis design on post-war cars is the almost universal adoption of independent front wheel suspension. Prior to the use of this system in car building, front wheel layout usually consisted of an axle beam connecting the two wheels and steering gear assembly, which was sprung longitudinally by two semi-elliptic springs beneath the side members, or in some instances by a transverse spring mounted across the chassis.

One of the most serious disadvantages of this system is the relative instability of the car when negotiating rough road surfaces, for as both road wheels share a common axle, any vertical movement in one is communicated in the opposite direction to the other, thus imparting an alternating rising and falling motion to each chassis side member and thence to the vehicle. (Fig. 1.) This is accentuated by the considerable unsprung weight as compared with the i.f.s. system. Front wheel wobble which frequently occurred with the solid axle layout was often due to the gyroscopic action of the wheels which occurred above certain road speeds. As the wheels tilted in an arc movement away from the road surface, Fig. 2, the gyroscopic forces set up a wobble in the front wheels which was greatly accentuated by wear and back-lash in the steering mechanism. The wobble rapidly built itself up into such proportions that an immediate stop was compulsory. Usually, cars that suffered from this serious defect behaved normally until the critical speed of gyroscopic action was reached.

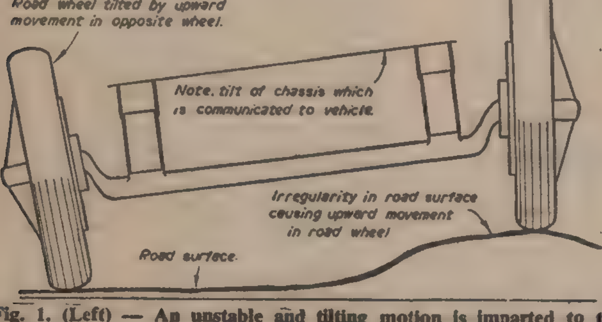
BACK-LASH IN STEERING GEAR

Quite often, in an older car with a beam front axle assembly, the overhaul and elimination of excessive back-lash in the steering gear will cure any tendency to wheel wobble, but, on some designs, an incorrect caster angle is responsible for the trouble and a steel wedge placed between the axle beam and each road spring, as shown in Fig. 3, may have the desired effect.

The undoubted advantages of the i.f.s. system lies in the fact that the deflection of any one wheel due to road irregularities, does not affect the other and the car rides on a comparatively even keel. (Fig. 4.) The considerable reduction in unsprung weight that is possible in the design, makes possible a far more flexible springing system. The springing arrangement nowadays usually consists of coil springs, which require practically no attention, although the various greasing points on the linkages and arms must be periodically attended to so as to ensure a smoothly working and trouble-free suspension.

WEIGHT DISPOSITION

On many modern cars the weight disposition is such that the higher proportion of vehicle weight is centred over the front wheels. This arrangement is quite satisfactory when carrying a full passenger load, but when the car is only occupied by the driver or perhaps by the driver and one passenger, the car is inclined to bounce on the rear suspension and induce a most disconcerting fore and aft movement. The road holding capabilities and riding comfort of a car with these tendencies can be greatly improved by removing the battery from its original position beneath the front bonnet and reinstalling same in a convenient position within the boot. (Fig. 5.) The earthing strap can be connected to a cleaned and lightly greased metal part of the boot by a nut and bolt, and the "live" terminal of the battery re-connected up with a length of heavy starter cable, making sure that the terminal ends of same are securely sweated in with solder. The cable should be clipped at intervals along the bottom of the car, avoiding the exhaust system and any moving parts which may break the insulation down. A slight voltage drop is to be expected, but this



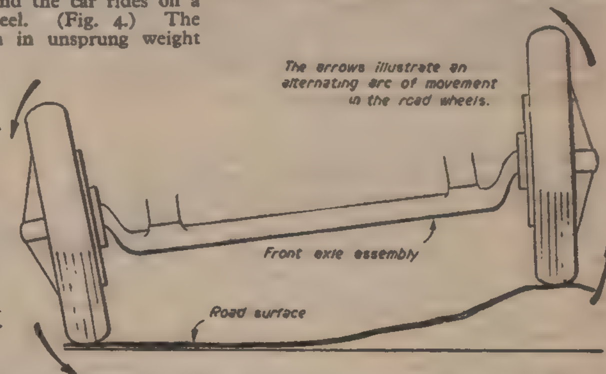
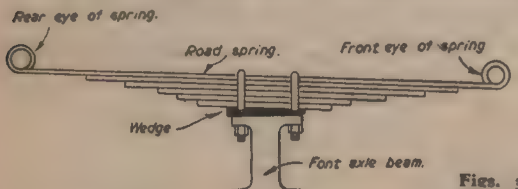
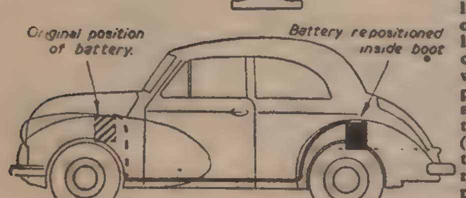
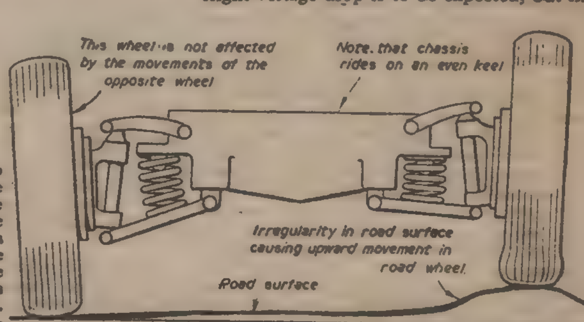


Fig. 1. (Left) — An unstable and tilting motion is imparted to the car where the two front wheels share a common axle. Fig. 2. (Right) — Moving over an irregular surface the front wheels describe arcs which disturb the gyroscopic forces in the wheels.







Figs. 3 to 5.—(Top left) A wheel wobble on solid front axle layouts can often be cured by inserting a wedge as above. The position of the wedge as shown increases the caster action. (Right). The advantages of the independent front suspension are clearly shown above. Note that car rides on an even keel when negotiating rough road surfaces. (Bottom left). A re-positioning of the battery to improve the weight disposition of some cars is explained in the text.

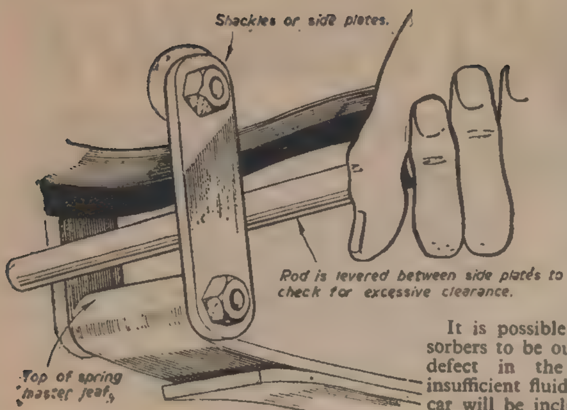


Fig. 6.—Excessive wear in either the spring shackles or bushes can be detected by applying a lever as explained in the text.

should have no adverse effect on the car's electrical system. It is best to house the battery in a strong wood box well painted both inside and out with bituminous paint. The box should be bolted to the floor of the boot with the heads of the bolts countersunk to avoid any damage being sustained to the battery container, and the assembly completed with a well-fitting lid drilled with a vent hole. If the battery is installed in this manner, there is no fear of any of the boot's contents being damaged by the battery acid.

An alternative plan which has been well tested in trials, etc., to avoid back wheel spin and skidding, and which ensures a better distribution of weight in some cars, is to place several small bags of sand within the boot, adding further or subtracting until a satisfactory balance has been reached. Due to the overhang of the boot in relation to the rear axle, no great weight is necessary—in most instances a total aggregate of 56lb. will be found quite sufficient. This procedure is, of course, unnecessary when the car is carrying a full passenger load.

SHOCK ABSORBERS

The most important unit of the suspension system of any car is the shock absorber. The purpose of the shock absorber is to dampen the flexing and frequency of the road springs under working conditions. In other words, an uncontrolled spring would give a violent kick to the car upon every bump or road depression and would continue to spring up and down until the force of the motion had expended itself in the friction between the sliding leaves and shackles, etc. A shock absorber, however, introduces a predetermined degree of friction or resistance to control the action of the springs. It will be appreciated from the foregoing that the stability of the car and the comfort of the passengers depends in no small measure on the efficiency of the shock absorbers.

On the non-adjustable types the setting as made by the manufacturers is largely a matter of compromise to obtain the best all-round results, and the owner can do little more than an occasional check-up on the linkages and bushes for breakage or wear, and a periodical retopping with the correct fluid for hydraulic shock absorbers. When removing the filler plug, care should be taken to brush away all dust and grit around same beforehand to preclude the possibility of any falling into the mechanism. Although the front shock absorbers are fairly accessible, the rear are sometimes very difficult to service, and it is often the best procedure to remove the rear wheels to gain access to the filler plugs. Again, on some cars it is necessary to remove the rear shock absorbers completely to attend to the topping-up. When this procedure is necessary, every care must be taken to hold the shock absorber in its normal working position during the filling and refitting. A good average mileage for checking the fluid content of the units is approximately every 10,000 miles, but, of course, the maker's recommendation should be adhered to in this connection.

TESTING

It is possible for one or more shock absorbers to be out of action, either through a defect in the unit or through having insufficient fluid. In such circumstances the car will be inclined to sway and excessively bounce when encoutering rough road surfaces, and a check on all four units should be made by disconnecting the linkage from the lower bush and pushing it smartly up and down. A fairly rapid movement is necessary, as most shock absorbers are designed to give very little damping effects at a slow axle movement, but to progressively increase the resistance with an increase in the force of the axle movement. If a resistance is felt upon the linkage, then it can be assumed that the shock absorber is functioning correctly, but if no

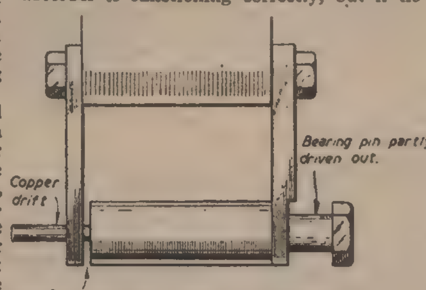


Fig. 7.—Excessive clearance between the side plates and spring bearings is taken up by the insertion of steel washers.

resistance is present, then that particular unit is out of action. Regarding this particular test, some shock absorbers are double-acting, i.e., impose a damping action on both the compression and rebound movements of the road spring. Other units are single-acting and only check the rebound of the spring. When testing the latter kind, the unit is in a satisfactory condition if a resistance is felt on only one stroke and none on the other.

A defective shock absorber should be replaced with a reconditioned unit, but if it is suspected that the trouble lies in lack of fluid, it can be refilled by topping up to the filler orifice, then working the linkage up and down and re-topping, and so continuing until no more fluid can be taken.

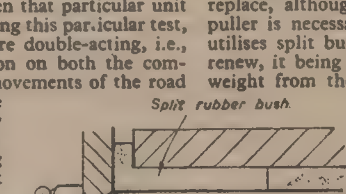
With the adjustable type of shock absorber, a wide degree of setting is made possible to the owner to suit his own particular requirements. Broadly speaking, fast driving and cornering capabilities are best suited by a "hard" suspension and the shock absorber settings should be made to increase the resistance or friction of same. Conversely, slower driving and rough road surfaces may call for a "softer" suspension and the shock absorber should be adjusted accordingly. When an adjustment of the shock absorbers is considered necessary, the resistance of both pairs must be evenly matched, otherwise the car will be inclined to sway or bounce more on one side than the other. It is therefore necessary to screw the adjusting screws by the same amount on each unit. A rough, but fairly accurate, test to ensure that each pair of shock absorbers is balanced is to rock each side of both the front and rear ends of the vehicle. If the degree of movement is approximately the same, it can be assumed that the shock absorbers are in balance with each other.

WEAR IN SHACKLE PINS

Wear in the shackle pins and side plates should be carefully checked by inserting an iron rod or tyre lever between the side plates (Fig. 6). The lever should be pressed down upon the top of the spring to reveal wear in the bushes, and between the side plates for excessive clearance between the spring bush and side plates where metal bearings are used. Wear between the side plates or shackles and the spring bush in metal bearings can induce a lateral sway in the vehicle at high speeds, and must be adjusted to reduce the clearance. The adjustment on some vehicles consists of removing a split pin from a castellated nut, then tightening same down until the clearance is correct, then reinserting a new split pin. Where no such adjustment is afforded, it is often possible to take up the excessive clearance by inserting steel washers between the spring bearing and side plates. The usual procedure is to remove the weight of the car body from the spring by jacking up the chassis, then release the shackle or bearing pin by removing the split pin and nut, then partly drive the shackle pin through the bearing with a copper drift. The necessary number of washers can then be inserted and the shackle pin tapped back into position and secured with a nut and split pin (see Fig. 7).

RUBBER BUSHES

Rubber bushes are usually fairly easy to replace, although on some designs a simple puller is necessary. A popular make of car utilises split bushes which are quite easy to renew, it being only necessary to relieve the weight from the spring as explained above, then remove the split pin and nut together with the bearing pin. After the two halves of the old bearing have been removed, all rust and scale is scraped away from the bush housing, the new bushes installed, and the spring assembly reassembled (Fig. 8). If difficulty is found in reinserting the bearing pin in the new bushes, a little soap



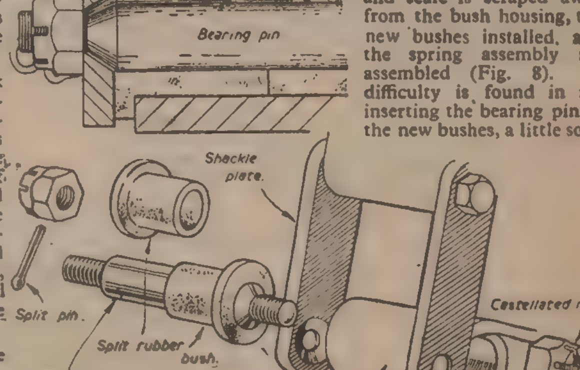


Fig. 8.—The component parts of one type of rubber bush. Note that the bush is in two separate parts.

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and water applied to same will facilitate matters. Before finally tightening the bearing pin nuts, the car must be jacked down.

Although it is the general and accepted rule to lubricate leaf springs with a light or penetrating oil, this should not be done with certain makes of car, as there is a plastic or rubber interleaving between the spring leaves which will quickly deteriorate under such a practise. If a slight squeak should be heard from such a spring arrangement—which is most unlikely—a little Lockheed brake fluid should be brushed along the outside of the leaves. Again, some cars have a thin zinc interleaving instead of rubber, and on both of these systems the need for lubrication is unnecessary, and highly undesirable in the case of the rubber interleaving.

ROAD SPRINGS

After a considerable mileage has been covered, most road springs tend to flatten and take on a "set.". Usually the nearside springs are the most affected due to the road camber, and springs in this condition impair the riding and roadholding properties of the car. Where the condition of the springs is exceptionally bad they should be removed and re-set by a firm who specialises in this particular branch of engineering. If the "set" is not too severe, however, a set of auxiliary or helper springs will do much to correct the trouble. A particularly efficient adaptation for new cars as well as old is illustrated in

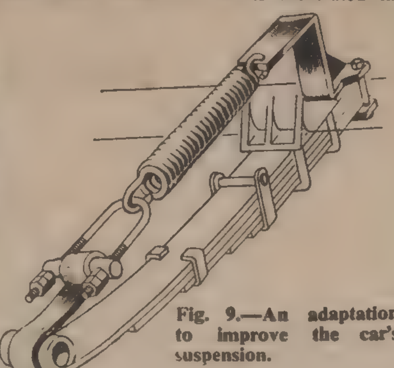


Fig. 9.—An adaptation to improve the car's suspension.

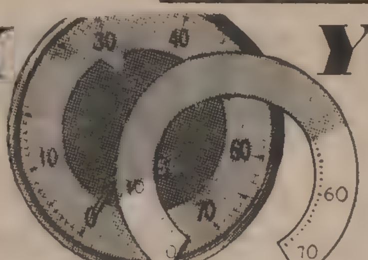
(Fig. 9). As the degree of control is variable, it can be set to suit one's individual requirements.

It is a bad policy to ride with over- or under-inflated tyres, for not only do the tyres have a reduced life, but the comfort and stability of the car suffer unduly. Over-inflated tyres give a very harsh ride with considerable wheel bounce and patter, while the effects of under-inflation are considerable rolling, especially on corners, and a hard and unresponsive steering action. Equally important is to ensure that both pairs of tyres are balanced by the correct air pressure, otherwise the car will tend to roll or pitch.

CAUSE OF WANDER

Excessive play in the front wheel bearings is a frequent cause of wander at high speeds and they should be periodically checked to see that this fault does not exist. If adjustment is required it should be made in accordance with the maker's instructions. If this is not available the usual procedure is to jack up the front end of the car, remove the split pins from each adjusting nut, then tighten same until the resistance of the bearings is felt when the road wheels are turned. (The adjusting nut on the right-hand side of the vehicle has a right-hand thread, while the nut on the left side has a left-handed thread.) The adjusting nuts are then slackened back a quarter to half-turn until just a perceptible shake is present in the bearings, then the nuts are secured with new split pins.

CHECK YOUR SPEEDO



● *How to make sure the speed indicator tells the truth*

THIS simple method of checking, or even calibrating, your own speedometer is based on the fact that there is correct inter-relation between the speed indicator and the distance indicator of the speedometer, and that the distance indicator should not be much in error, as will be explained. The required self-consistency, which provides the method of checking, is that if for instance the speed indicator shows 30 m.p.h., exactly two minutes should elapse whilst the distance indicator advances by one mile. In general the time will be found to differ slightly from the two minutes: the actual time enables the actual speed to be obtained.

To check a speedometer by this method, choose a fairly straight traffic-free road, and drive along it at a constant speed, say 30 m.p.h., as indicated by the speedometer. Have an observer with you: with a watch or, better, a stop-watch, he notes the time in seconds required to travel exactly one mile shown on the distance indicator. The "tenths" indicator usually moves sufficiently precisely for this time to be obtained to the nearest second or closer.

SPEED IN M.P.H.

The actual speed in m.p.h. is given by dividing 3,600 by the time in seconds required to travel one mile. It will often suffice merely to check the 30 m.p.h. point on the speed indicator. If, for instance, the actual speed proves to be 33 m.p.h., then, roughly, an indicated 27 m.p.h. will give an actual speed of 30 m.p.h.

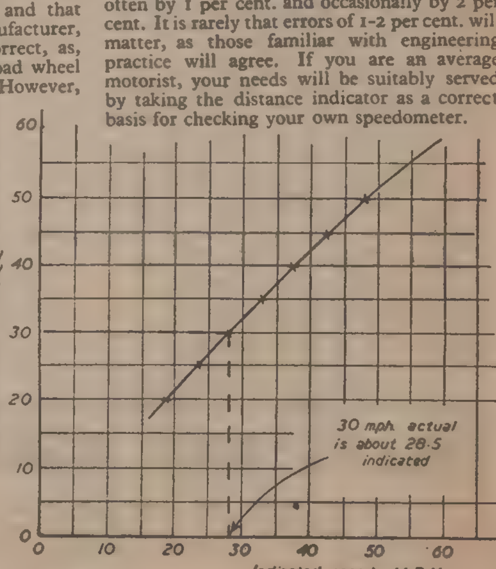
Usefully, a calibration of the most used range of the speedometer can be performed by taking a series of indicated speeds, as 20, 25, 30, 35, 40, 50 and even 60 m.p.h., and obtaining the corresponding actual speeds from tests as the above. The actual speeds should be plotted on a base of indicated speeds, and a smooth curve drawn through them as shown, using squared paper. By setting off a series of actual speeds at 5 m.p.h. intervals, the points on the indicated speed scale, on which the new calibrations should be put, can be read from the curve: the 30 m.p.h. point is shown

A paper scale, with these calibrations in black ink, can then be made and pasted over the original scale, or under, or even (for temporary use) over, the speedometer cover glass.

The speed indicator having been calibrated against the distance indicator, the latter being presumed correct if speeds are to be indicated correctly, the speed error will be the same as distance error, which will now be discussed.

DISTANCE INDICATOR

It will be realised that the distance indicator is geared to the road wheels so that so many revolutions of the road wheel cause the indicator to advance by one mile, and that this number, chosen by the manufacturer, remains constant and should be correct, as, indeed it will be for the effective road wheel diameter assumed in its installation. However, with only the driver aboard, and rear tyres possibly over-inflated by a pound or two per square inch, the effective rear wheel diameter will be larger than normal The car will thus travel more than a mile whilst the distance indicator advances one mile, since the indicator merely measures the number of revolutions of the rear wheels, but gives the result in miles. Distance and speed indications will thus be low. Conversely, with a car with four or five passengers, all their luggage, and worn and under-inflated tyres, the effective rear wheel diameter will be smaller than normal, and distance and speed indications will both be high.



Plot of actual speeds on base of indicated speeds.

TYRE PRESSURES

The only way of obtaining high absolute accuracy after making the speed indicator closely self-consistent with the distance indicator, is thus to watch rear tyre pressures and to relate them slightly to tyre wear and to car load. With the recommended pressure and two to four seats occupied in the medium-weight car, errors of distance, and hence of speed, should not generally exceed 2 per cent.

This is seen by reference to the test results that have been published for various cars. Under those test conditions, distance indicators are sometimes slightly high in their reading, often by 1 per cent. and occasionally by 2 per cent. It is rarely that errors of 1-2 per cent. will matter, as those familiar with engineering practice will agree. If you are an average motorist, your needs will be suitably served by taking the distance indicator as a correct basis for checking your own speedometer.

STOPLIGHT FITTING FOR 1936 MORRIS 8

A GREAT advantage of this method of fitting a stoplight to a 1936 Morris 8 is that it involves no drilling of the brake pedal crank. Fig. 1 shows the layout and Fig. 2 the component parts of the unit.

The mounting from the switch is in the form of a

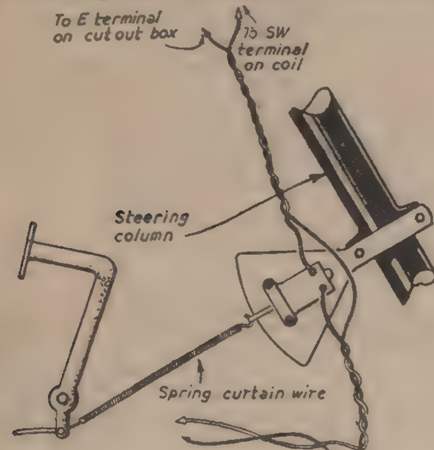


Fig. 1.—Layout of the stoplight fitting.

near quadrant fastened to the steering column by a clip held by suitable nuts and bolts. The incidence of operation of the switch is obtained by sliding the mounting up or down the column before tightening up. During this operation the bolts and nuts securing the switch to the plate should be left finger-tight only. Then, owing to the curved slotting in the plate, the switch will automatically take up its proper position

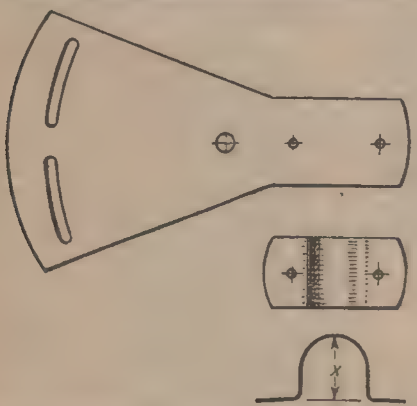


Fig. 2.—Component parts of the fitting

dead in line with the direction of the pull. All nuts can then be tightened.

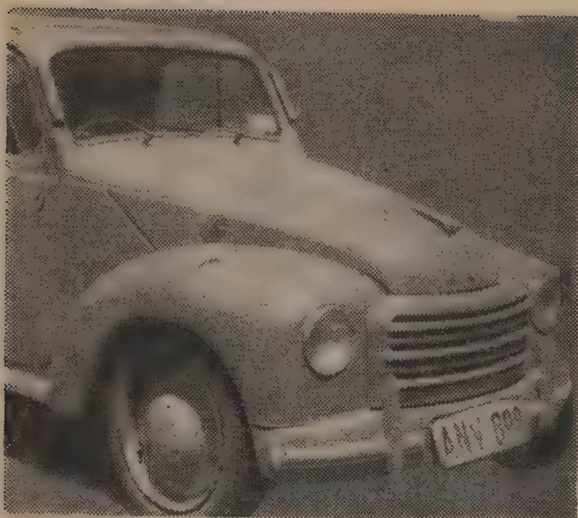
Incidentally, some mechanics contend that this mechanical type of switch is superior in operation to the hydraulic type in that it can be adjusted to light up before pressure is applied to the brake.

Since in some old cars the earth return system is not reliable, it is advisable in the interests of safety to run a twin cable connecting to the E terminal on the cut-out box and cutting in with the positive in the ignition system. This is clearly indicated in Fig. 1.

SERVICING th

● *Part 1. Essential data of three models w*

for removing and dismantling engine,



CONSTRUCTED on principles employed by makers of much larger vehicles, the Fiat 500 is one of the most successful of really small cars. The design is individual, yet basically orthodox, the main features including a well-braced chassis, independent suspension at the front, hydraulic brakes, four-cylinder water-cooled engine, single-plate dry clutch, four-speed gearbox, spiral bevel rear axle with differential, worm and sector steering.

There are three types of vehicle, with differences in engine and other

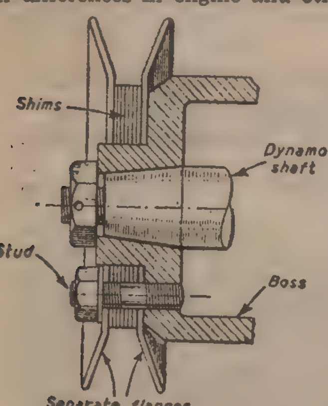


Fig. 1.—Fan belt adjustment.

features—the Model 500, Model 500 B and Model 500 C.

MODEL 500

The Model 500 engine is a side-valve, 52 mm. bore, 67 mm. stroke, capacity 570 c.c., compression ratio 6.7 to 1, producing 13 brake horse-power at 4000 r.p.m. The steel crankshaft is carried in two main bearings, connecting rods being steel, pistons aluminium alloy, and the sump in pressed steel. The cylinder block is phosphor-manganese cast iron, and the head aluminium alloy.

Valves are operated through a side camshaft, chain-driven from the forward end of the crankshaft, adjustable flat-based tappets working in the cylinder block. Generator and fan are mounted on the cylinder head and driven by belt from a pulley on the front of the crankshaft.

Early oil pumps were vane type, later replaced by gear type, skew-gear driven from

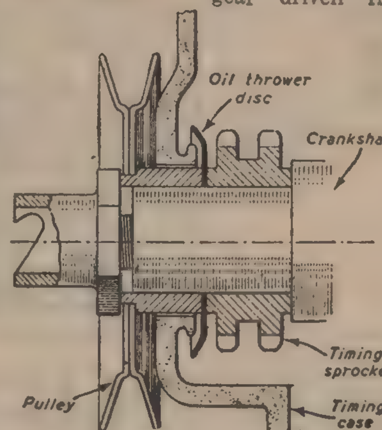


Fig. 2.—Oil thrower on front of crankshaft.

the forward end of the camshaft, submerged in the sump and supplying the chief bearings—crankshaft main bearings, big-end bearings, camshaft bearings — under pressure of 35lb. per sq. in. Distributor drive is arranged vertically through the cylinder head in line with the vertical shaft of the oil pump. At the rear of the engine the flywheel is fitted by means of a step or register over the large diameter end of the crankshaft and secured by setscrews.

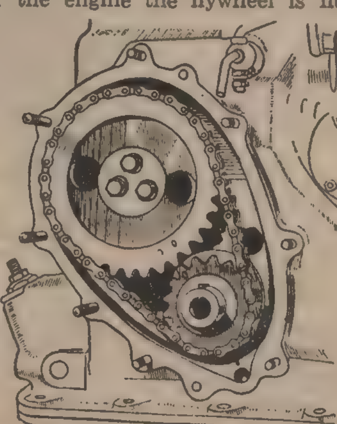


Fig. 3.—Reference marks for valve timing.

MODEL 500 B

The Model 500 B employs push rod operated overhead valves. Bore and stroke are 52 mm. and 67 mm. respectively. The compression ratio is 6.45 to 1, and the brake horsepower 15. The cylinder head is in phosphor-manganese cast iron, and the connecting rod bearings are thin-wall type (also fitted to later Model 500 engines). A down-draught carburettor is fitted to a modified intake and exhaust manifold. The generator is mounted on the side of the crankcase, the fan being on the cylinder head, and the belt drive thus triangulated round the three pulleys.

Oil pump and distributor driving shafts are arranged vertically and in line, and a fuel pump is driven from the oil pump shaft. The filter and release valve for the lubrication system are accessible from outside the engine. Valve rocker shaft is pressure fed.

Fig. 4.—Nearside view of engine.

A crankcase ventilation system is arranged through pipes connecting the intake of the carburettor to the crankcase breather and the valve cover.

The oil seal at the flywheel end of the crankshaft is a rubber type packing in place of the previous oil thrower. This feature can be incorporated on earlier engines by renewing the flywheel and the rear main bearing housing in which the seal is fitted.

Connecting rods with the thin-wall bearings can also be used on earlier engines in complete set of four.

MODEL 500 C

The Model 500 C engine is basically the same as the Model 500 B. The main differences are that the

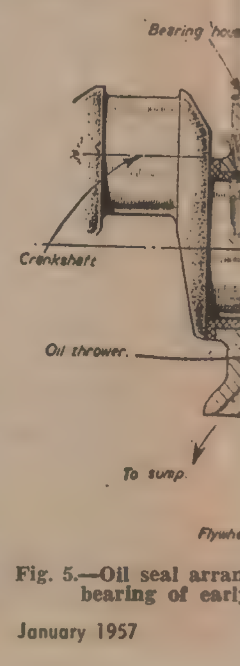
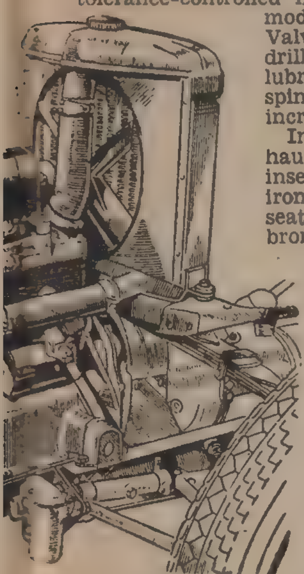


Fig. 5.—Oil seal arran bearing of earl

e FIAT 500

with instructions
hecking bearings, conrods and pistons

cylinder head is aluminium alloy with bronze valve seat inserts, inlet and exhaust valve diameters are reduced, and the seating angles now tolerance-controlled in keeping with modern practice. Valve rockers are drilled for improved lubrication. The fan spindle diameter is increased.

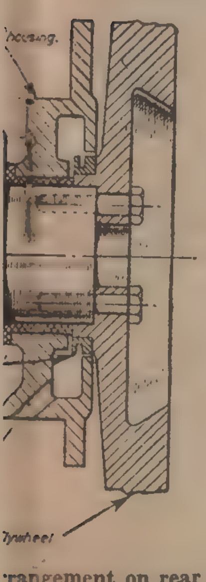


In some cases exhaust valve seat inserts may be cast iron, while inlet seat inserts are bronze.

The principle of the fan and generator belt adjustment is the same for all engines, as in Fig. 1, with shims placed between the separate flanges of the driven pulley, so that when the pulley is dismantled and shims removed the flanges then fit closer together, and the belt is tightened by riding at a larger radius on the conical faces.

LUBRICATION—OIL SEALING

The oil "seals," or more correctly "throwers," fitted to Model 500 engines are standard automobile practice, and are shown in Figs. 2 and 5.



...rrangement on rear ...early engines.

The front seal, where the crankshaft projects through the timing case, consists of a pressed steel hollow disc, fitted hollow side forward, and gripped between the end faces of the crankshaft sprocket and the crankshaft pulley, both of which items are secured by the starting dog screw. The inside of the timing case, close to the thrower disc, is provided with a circular "lip" over which the oil is flung by the thrower. The discharged oil thus runs round the groove formed by the lip with the end of the casing, falls to the bottom of the casing, and returns to the sump. The bore in the casing should be a reasonably close fit round the boss of the crankshaft pulley and centralised so as not to rub on one side.

With the engine maintained in good mechanical condition a seal of this type should be virtually trouble-free. The seal at the rear of the crankshaft, Fig. 5, is a similar type of thrower, though here conditions of operation are somewhat different, and on occasion trouble is experienced. In the case of the front seal there is no closely adjacent pressure oil supply from which oil can be delivered direct to the seal thrower, since the front bearing is behind the crankshaft sprocket. Moreover, the general construction of the pressed steel thrower is sharper and more positively lipped, and its action thus superior.

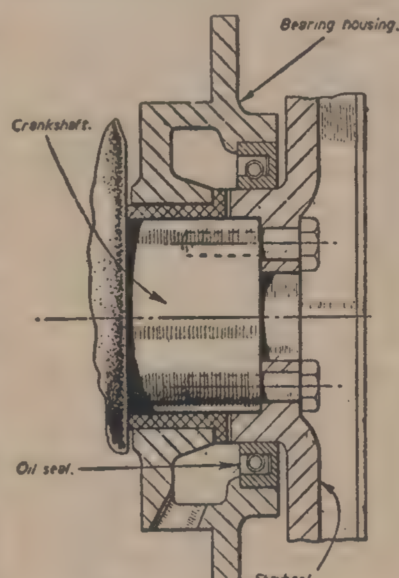


Fig. 6.—Modified oil seal on later engines.

In the case of the rear seal, however, there is a pressure supply of oil to the rear bearing, and the lip of the thrower cannot be made so prominent as it is machined in a narrow ring. The seal depends for effectiveness on the rear bearing being in good condition, the thrower itself clean, and the housing a good fit about the rear portion of the ring. Any oil which exudes from the bearing is then flung into the circular channel in the bearing housing, and drains from the bottom to the sump. When the rear bearing becomes worn, the thrower coated with carbon, and the housing perhaps worn (as a result of bearing slackness), oil is likely to escape past the seal into the clutch housing. The modified oil seal shown in Fig. 6 incorporates a rubber packing which bears on the flywheel boss, and there is thus substituted an actual running fit in place of the previous clearance. This generally cures the trouble of oil leakage past the rear seal.

OIL RELIEF VALVE

A suction strainer or filter is fitted to the oil pump in the sump, and there is a delivery filter on the side of the crankcase, with which is incorporated the relief valve on Models 500 B and C. The relief valve of the Model 500, Fig. 7, is fitted inside the sump at the bottom of the front main bearing, and it is necessary to remove the sump to gain access. Ordinarily, if the valve is inspected and the seating and spring found to be in good condition during an overhaul, no trouble should be experienced until there is further occasion to remove the sump —when any deterioration would be seen.

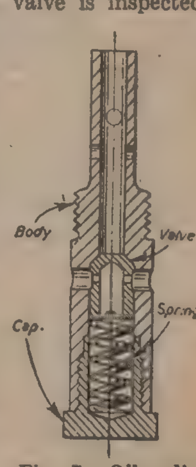


Fig. 7.—Oil relief valve fitted below front main bearing.

DECARBONISING

It is advised not to remove the cylinder head while the engine is hot, owing to the possibility of distortion — this

in particular reference to the side-valve engine.

On the o.h.v. engines there are two head holding nuts inside the water jacket connections, one at each end of the head on the near side; these must be removed with the others. The side-valve head is freed, should it stick to the gasket and block, with a lifter of the type shown in Fig. 8. The o.h.v. head should come with lifting or sideways and upwards blows with a rubber mallet to free it. In each instance the preliminary dismantling of fan drive, distributor, etc., must have been done, and on o.h.v. engines the rocker lubrication pipes removed from the hollow stud. Valves may be removed with normal spring compressors.

Side-valves employ a simple groove for the collet, Fig. 10, but overhead valves have a groove for a safety ring farther along the stem.

Valves may be serviced with normal equipment or with the special tools available. Valve stem clear-

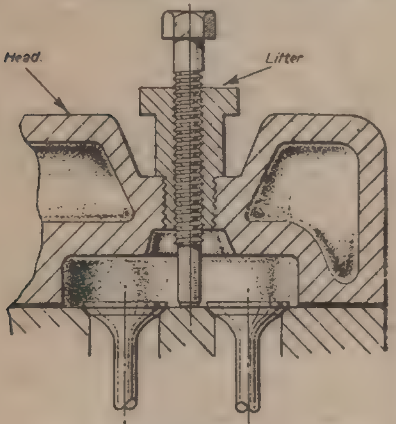


Fig. 8.—Special lifter for freeing cylinder head.

ances in guides should not exceed .006in. Valve head depths and seat depths, Fig. 10, are 1.5 mm. for all engines, and the seating angle is 90 deg. for Model 500 and 500 B engines, with correspondingly angled seats. On later Model 500 C engine valves the seat angle is given in another manner, more precisely as 45 deg. 10 min. to 45 deg. 30 min., plus or minus 5 min.; and the cylinder head seat angle as 44 deg. 50 min. to 45 deg., plus or minus 5 min. This provides a high pressure type of seating, ensuring a better gas seal. All valve guides are flangeless type, as in Fig. 10, and may be removed with a drift.

VALVE AND SPRING DIMENSIONS

Main dimensions of the valves are as follows:

Model 500

	Head diameter	Smaller diameter of seat
Inlet valve:	22 mm.	19 mm.
Exhaust valve:	20.5 mm.	17.5 mm.

Model 500 B

	Head diameter	Smaller diameter of seat
Inlet valve:	26 mm.	23 mm.
Exhaust valve:	24.5 mm.	21.5 mm.

Model 500 C

Inlet valve diameter reduced from 23 mm. to 20 mm.; exhaust valve diameter reduced from 21.5 mm. to 18 mm.

Model 500 valve springs: free

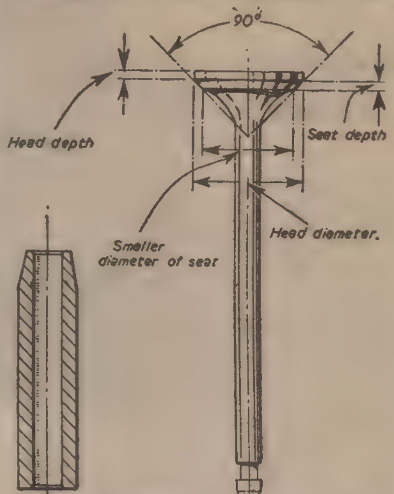


Fig. 10.—Valve and guide.

length 39.8 mm., outside diameter 21 mm., compressed length 27 mm. with a load of 18.7 lb. Model 500 B and C valve springs: free length 42.1 mm., outside diameter 23.5 mm., compressed length 27.8 mm. with a load of 35 lb.

CHECKING COMBUSTION CHAMBERS

If the engine shows a tendency to run unevenly, the combustion chambers can be checked to see whether they are all of equal volume. It will be noted also if there are any rough spots in the metal or at the base of plug holes. Protrusions should be removed by scraping or polishing with abrasive cloth, followed by a thorough clean. For the side-valve engine it is recommended to check combustion chamber capacity with the head fitted to the engine, valves of the tested cylinder closed, and using a graduated measure with castor oil and benzole.

On other models it is much more convenient to check when the head is off, sparking plugs being fitted and o.h.v. ground in and fitted. The head should be blocked up level upside down (spirit-level test). A graduated beaker, as used for photography, can be used to pour kerosene into the combustion chamber, just level, and the volume verified. Corrections can be made to small chambers with

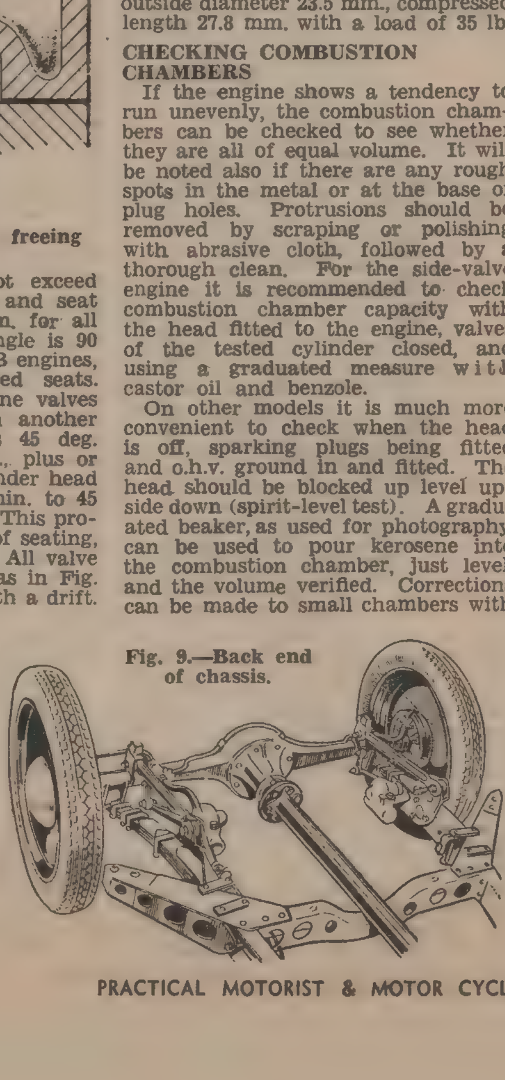


Fig. 9.—Back end of chassis.

scrapers and abrasive wheels in such a manner as to preserve the general contour but increase the capacity.

REMOVING ENGINE

It is not possible to remove engine or gearbox separately. Whenever they (or the clutch) require major overhaul they must be removed as a unit.

The car should be jacked up front and rear (if no pit is available), the water drained, the battery disconnected, and minor accessories and controls removed.

Bonnet and grille should be taken off, water hoses disconnected from the radiator, and the radiator itself removed. Fixing bolts of gearbox to rear mounting should be removed, and the following disconnected: speedometer cable, earthing cable from gearbox, clutch rod, propeller shaft from gearbox, transmission brake rod. The cap and rubber for rear mounting of unit should be removed. Engine side trays and exhaust pipe should be disconnected, together with carburettor feed pipe and silencer, accelerator rod and starter control wire, oil pipe from engine base, coil wire, generator and starter leads, horn wires and horn.

The cross-member connecting the front ends of the wings must be removed, also the caps and rubbers of the front mounting. The gear lever may be unscrewed with a punch in the hole provided. The assembly is brought out by moving forward and lifting.

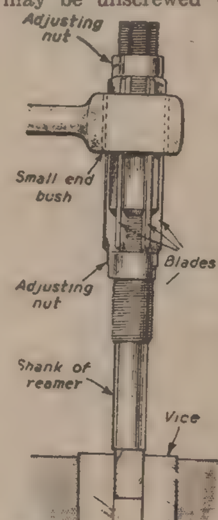


Fig. 11. — Reaming conrod little-end.

DISMANTLING

The sump should be drained, if this has not already been done, and the engine and gearbox separated. The clutch assembly is released by evenly removing the nuts on the ends of the pillars in the flywheel. The flywheel can be removed later by taking out the setscrews from the crankshaft. For the time being the flywheel can be held while the starting dog setscrew at the front of the crankshaft is loosened. The pulley should carefully lever off when the setscrew is removed, exposing the timing case for removal. The cylinder head can be removed (including the distributor, fan spindle or generator), and also the starter motor, manifold, etc. With the timing case removed, the camshaft wheel is disconnected by taking out the setscrews from the end of the camshaft so that the wheel and chain can be removed. A puller is then required to withdraw the camshaft sprocket.

With the engine upside down, the sump, oil pump and spindle are re-

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moved, and the flywheel taken off. This is followed by the big-end caps from the connecting rods, the crankshaft rear bearing and the front bearing (including the pressure release valve). The crankshaft is removed rearward, being manipulated past the connecting rods, which, with the pistons, are removed downward. Valves being removed, the camshaft is drawn out from the front.

When removing Model 500 C engines and gearboxes, the valve rocker cover and fan should be removed with the air filter, then the unit lowered at the back and lifted at the front to avoid dismantling the front cross-member.

ENGINE CLEARANCES

The chief engine clearances to check are as follows:

There are three sizes of original cylinder bore diameters: A, 52 mm. to 52.01 mm.; B, 52.01 mm. to 52.02 mm.; C, 52.02 mm. to 52.03 mm. Similarly there are three sizes of pistons according to the diameter across the skirt at the gudgeon pin: A, 51.957 mm. to 51.967 mm.; B, 51.967 mm. to 51.977 mm.; C, 51.977 mm. to 51.987 mm. With these diameters new clearances in the cylinders range from .0053in. to .0061in., which dimensions can be checked with feeler gauges.

Piston ring gap clearances new should be about .005in., side clearances in grooves as follows: top compression ring, .0012in. to .0023in.; intermediate rings, .0008in. to .0019in.; bottom oil ring, .0006in. to .0017in. Gudgeon pin interference fit in piston .0003in.; clearance in connecting rod little-end .0004in. In regard to the crankshaft, main bearing clearances new should be between .0008in. and .0026in.; end play at rear main bearing .0015in. to .006in. Big-end bearings with the thin-wall type of bearings should be correct for fitting; the clearances should actually be about .0004in. oversize, then the bearing burnished to a high surface finish. End play on big-ends should be .008in. to .010in.

Should main bearing and big-end clearances exceed about .004in. new bearings should be fitted in conjunction with grinding of the crankshaft if this item is scored or oval. Maximum wear clearances on the camshaft and bearings are .006in. On the oil pump bearing in the crankcase, on the shaft in the pump, and on the gears in the pump body, maximum clearances are .006in. Maximum clearances of the tappets diametrally in the crankcase are the same .006in. Oversize tappets and gudgeon pins are available, and in regard to the gudgeon pins it is recommended that the necessary fit be obtained with an expanding reamer, as in Fig. 11.

CONROD AND PISTON BALANCE

Big-ends and little-ends of the conrods must be in exact alignment, and the caps of the rods must not be filed to fit the bearings. Also of considerable importance for the smooth running of the engine is the balance of the pistons and conrods. All the pistons should be the same weight as near as possible, within a tolerance of 2 grammes. Heavy pistons should be machined in a lathe inside the skirts to bring them to the same weight as lighter ones. The check on weight should advisedly be made with the gudgeon pins included to allow for variations in the weight of these items. These must be kept, as always, to their proper pistons.

(To be continued)

BUILD your own CARAVAN

PART 3: Completing the van for occupation

WITH the electric wiring complete, interior lining ply fitted, and cupboards and other furniture installed, your caravan needs only the finishing touches to make it ready for the road.

HATCH COVER

First step is to finish off the hatch opening and make its cover.

With a sharp knife (a lino knife answers the purpose well) cut a hole in the roof canvas flush with the opening already made in the ply. The opening is now framed on the outside with 1¼in. x ⅞in. oregon. Run a layer of waterproofing compound, such as Adfast, between the frame and the canvas and fix the frame from the inside with ½in. No. 6 wood screws.

The hatch cover is also framed up in oregon and faced with waterproof ply. Its frame is ¼in. larger all round (inside measurement) than the opening frame, over which it fits. Hinge the cover with a pair of 2in. butt hinges so that it opens from the front. A dropleg support holds it in the open position. With the opening at the front the hatch scoops up air so that the van is pressurised as it moves along. Incidentally, make sure that the screws holding the hinges go through into the roof cross-member adjacent to the hatch opening.

WINDOWS

Windows come next on the list. Fit the sills first, sealing them with the same waterproofing compound as you used on the hatch. Frames are made of 2½in. x 13/16in. oregon. If you prefer you can leave them unglazed until the painting is done.

Opening sashes are hinged at the top and fitted with casement-type stays and fastenings. Rear windows should be fixed, non-opening sashes. This will help to keep dust out of the van. Window details are shown in Fig. 12.

Flyscreens are considered essential in a well-equipped caravan. Frame them up in 1in. x 13/16in. oregon, and fix the bronze gauze with half-round wood beading. As windows open outward, screens must be fitted inside and hinged to allow access to window fastenings.

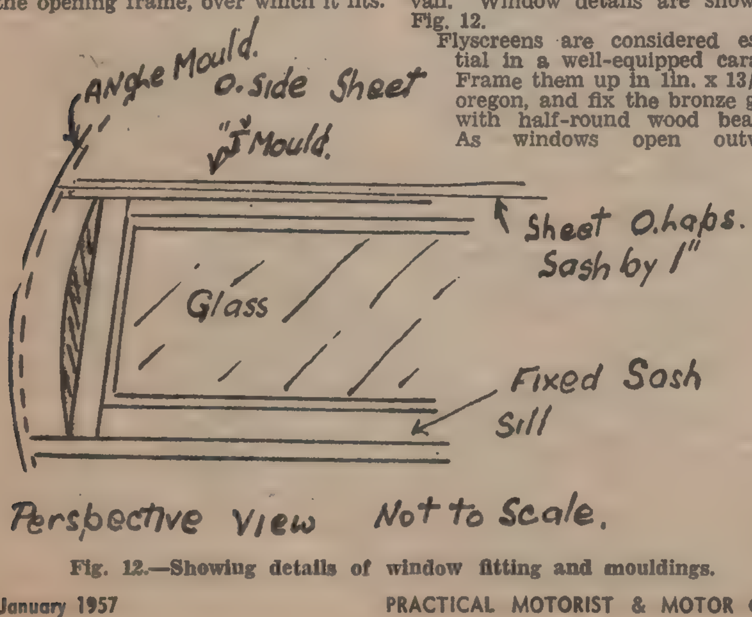


Fig. 12.—Showing details of window fitting and mouldings.

EXTERIOR BEADING AND GUTTERING

The joint between roof and side walls is covered with ⅞in. x ⅝in. aluminium angle beading. This usually comes in 12ft. lengths. Starting from floor level at the front of the van, run a length of beading up over the curve, fixing it with ½in. No. 4 screws at 9in. centres. Then fix a similar strip starting from the rear floor level, finally filling in the gap between the ends of the two strips with a piece cut to the required length.

Now take your lino knife and trim off the canvas overhang flush with the beading.

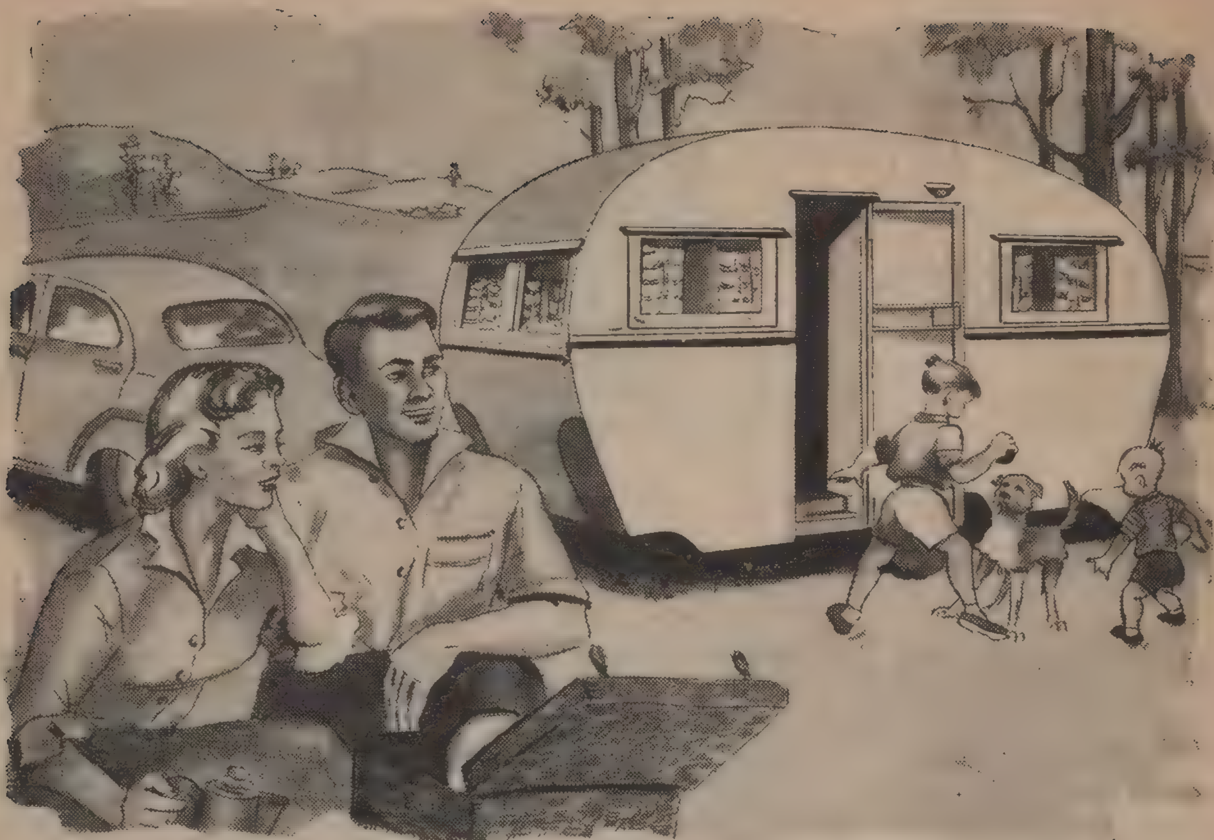
Aluminium J-mould (15/16in.) is used for guttering. Strips of this are fixed right across the front and rear of the van flush with the tops of the windows. Strips fitted over each of the side windows should be 38in. long so as to leave a small overlap at each end. (See Fig 12).

Both beading and guttering must be made water-tight with a very heavy coating of white lead paint (or a patent sealer such as Seelastick) laid on beneath them.

WATER TANK

The water tank must be installed at the nearside rear of the van before the rear seat is completed. Water is pumped by hand or foot pump from the tank to the sink through a piece of clear plastic (non-toxic) hose passing up through the floor directly under the sink and connecting with the sink spout.

This spout goes through the wall at an angle, so the hole to accommodate it must be cut to an ellipitical rather than a circular shape. An aluminium disc slipped over the spout and screwed to the wall neatens the place where the spout protrudes. A layer of waterproofing compound between disc and wall effectively seals the joint. Plastic hose ⅜in. in



First trip in your own van, all the more fun because you built it yourself. Text details completion and registration.

diameter is used to drain the sink through the floor.

ICE CHEST

It's best to buy the metal lining for the ice chest ready made from a caravan equipment firm. Insulate it with a 1½in. thickness of rock-wool fibre, for example Insulwool, and two ½in. thicknesses of fibreboard, such as Caneite. A length of ½in. diameter plastic hose provides a drain for the ice chamber.

COOKING RECESS

An aluminium lining, which can be bought ready made, is recommended for the cooking recess both for the sake of cleanliness and to reduce the risk of fire. Fumes are carried off by a metal flue with its outlet through the roof.

An opening porthole fitted into the wall at the back of the stove will give additional ventilation. These can also be obtained ready to install.

PAINTING

Your paint color scheme will be a matter of personal choice. As far as the interior is concerned it's wise to decide on your furnishing fabrics before you buy your paint so that you'll get overall harmony.

Final coating of the roof should be done with a good quality aluminium paint. (Silvasheen is a reliable one.) Then the whole of the rest of the exterior should be hand painted with a coat of oil primer. Make this of 60 percent linseed oil and 40 percent white lead thinned to painting consistency with turps and terebine dryers. Allow 48 hours' drying time.

Next apply two coats of "filling" undercoat (such as Preparakote) to fill the grain of the wood. Coarse-grained ply may need three coats. Each coat should be allowed to dry overnight.

To make a really smooth surface for finishing cut back the undercoating with No. 180 wet and dry rubbing paper used dry. Then finally lay on one or two coats of good brushing enamel.

Inside walls and furniture should be treated to one or two applications of the filling paint, cut back with rubbing paper as for the outside, then finished with flat or gloss enamel.

Paint quantities required are approximately as follows: For the outside, ½ gallon primer, prepared as indicated above; 1 gallon filling paint; 1 gallon gloss enamel. For the inside, 1 gallon filling paint; 1 gallon enamel.

FURNISHINGS

Curtains are best hung on spring-type curtain wire held in place with screweyes and hooks. Please yourself whether you thread wire through both top and bottom hems or at the top only.

Benches in the dinette and the lounge seat at the rear of the van convert to double beds, so padding ideally takes the form of mattresses, either 6in. thick innerspring or 4in. thick sponge rubber, covered with fabric to tone with your curtains. For the dinette you'll need one mattress 6ft. 2in. x 2ft. 2in. and one 6ft. 2in. x 1ft. 6in. For the lounge seat with back rest, have two pieces 3ft. 6in. x 1ft. 11in. and two 3ft. 6in. x 1ft. 2in. It's as well to order your mattresses before the van is completed as they take some time to make up.

Linoleum makes the most satisfactory floor-covering. Either malthoid or paper felt should be laid under it, so it's a good plan to fit and cut this first and then use it as a pattern for cutting the lino. When you've laid the lino, leave it to stretch for at least a month before you finally tack it down. A strip of ⅜in. x ¾in. angle mould fixed at the doorstep will reduce wear at this point.

REGISTRATION

Don't forget that before you can take your van on the road it must be registered. First you must obtain a permit to allow you to tow it to the motor registry for inspection. On the way there have the van weighed so that you can take the weight certificate with you.

Main points that will be checked at the registry are the efficiency of clearance lights and tail light, ground clearance, and the efficiency of the van's braking system. The brakes must actually lock the wheels of the van.

THE END

make this—
DUAL-PURPOSE LAMP

● *Trouble light and battery charger in one unit*

AN all-purpose lead lamp that can be used anywhere about the car is a "must" in any motorist's equipment. You can make a lamp that, by means of a simple addition, becomes an efficient battery charger.

Connect one end of a suitable length

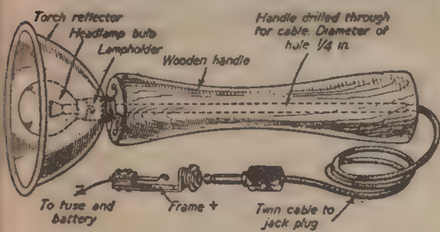


Fig. 1.—Showing method of constructing the inspection lamp, also the jack and plug before fixing to the facia panel.

of flex to a bayonet cap holder mounted on a wooden handle. (See Fig. 1.) Add a torch reflector and a headlamp bulb.

Now from a radio-parts store obtain a good-quality open-circuit electric "jack" with plug. The function of the jack is to open or close the circuit when the plug is inserted or withdrawn. The jack can be fitted to the dashboard of any car without being unsightly, for the only part that remains visible is a nickel-plated ring of about $\frac{5}{8}$in. diameter surrounding a $\frac{1}{2}$in. hole, the jack barrel, into which the plug fits.

Drill a $\frac{5}{8}$in. hole in the dashboard, insert the jack from behind and tighten the nickel ring. The frame of the jack will automatically be earthed to the car if the dashboard is metallic. If it is not metallic, run another wire from the frame of the jack to the frame of the car. Attach a suitable cable to the insulated side, or spring leaf, connecting this to the battery negative via a fuse. Attach the twin-flex from the light to the jack plug and insert the plug.

The advantage of being able to plug the light in from inside the car instead of having to connect it to the battery by means of the usual crocodile clips is obvious.

CHARGING BATTERY

For battery-charging no alteration is necessary to the circuit. The only requirement is a second jack-plug attached to the output of the charger. In post-war cars employing the posi-

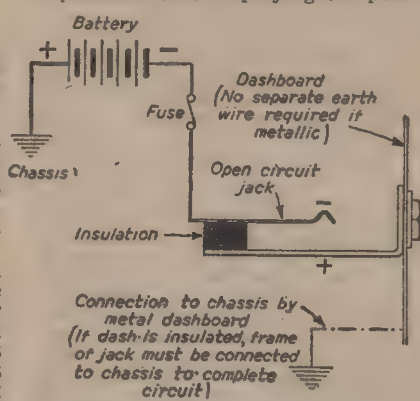
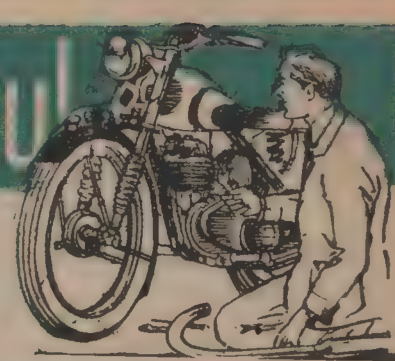


Fig. 2.—Theoretical circuit of the inspection lamp. On older cars it must be ascertained whether the positive or negative side of the battery is earthed.

tive to the chassis, care must be taken to ensure that the negative lead from the charger is connected to the ball-tip of the plug and the positive to the stem.

"... And, frankly, I didn't have a lot of money to spend on a garage."

Motor cycle overhaul



● *Dismantling crankshaft assembly, checking big-end wear, some easily made special tools*

Part 4

HAVING dealt in a previous article with methods of checking the timing of an engine, dismantling the gear, removing sprockets, bushes, and so on, it remains only to indicate the points in a typical timing gear where minor improvements can be made without resorting to new components.

The immediate effect of wear in the timing gear is roughness and noisiness, which, as a rule, become apparent before performance falls off to a noticeable extent—for the average owner at least. Motor-cycle timing gear, moreover, tends to be subject to wear to a rather greater extent than that of some other types of engine owing to the high loadings occasioned by heavy valve springs, which are necessary to meet the performance demanded.

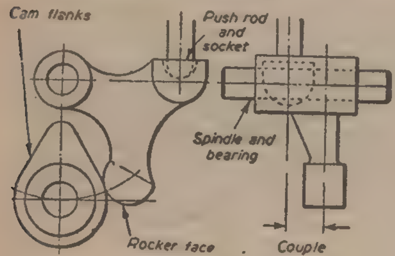


Fig. 32.—Likely points of wear in timing-case cam and rocker gear.

POINTS OF WEAR IN TIMING GEAR

The cam flanks, the rocker faces, the tappet feet or the push rod sockets and push rod ends, as indicated in Fig. 32, are the points where wear occurs. Cam flanks become ridged, in some instances with almost a corrugated effect. Often there are distinct areas each side where wear has been concentrated, the valve having been bounced open against the pressure of the spring, the spring then having returned the gear with a bump on the other flank. Ridges are caused by irregularities of movement occasioned through the driving gears or by backlash between them.

Radiused faces on rockers become ridged or flattened; flat faces are worn hollow. When the rocker gear incorporates a couple between the points of application and transmission of lift, the spindle and bearing may reveal greater wear because of the load applied.

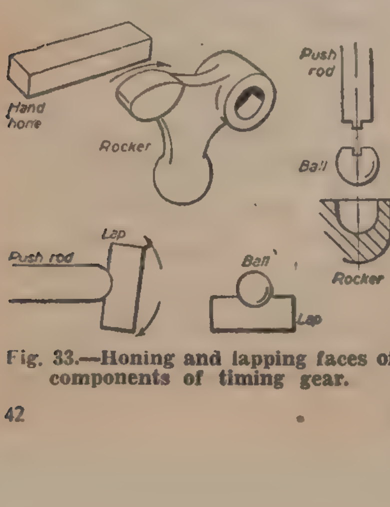


Fig. 33.—Honing and lapping faces of components of timing gear.

REMEDIES FOR WEAR

Faces of timing gear components revealing wear which is not too advanced can be rectified by the methods depicted in Fig. 33, and even in bad cases a considerable improvement can be made. On cam flanks and rocker faces irregularities are easily smoothed with a small hand hone lubricated with kerosene or thin oil. Care should be taken to keep the hone square across the face, to hold it flat, or to impart to it the necessary quasi-circular movement. When wear has left a considerable ridge on one side of a face, careful grinding will reduce the ridge to save wear on the hone. It is important not to carry the grinding too far or to advance across the face and render it askew.

For a ridged or deformed push rod end a lap can be made by indenting a small block of lead with a steel ball of suitable size, then using valve-grinding paste while spinning the rod and oscillating the lap. Alternatively a piece of brass rod can be lightly countersunk at the end, then the ball driven in to form a radius. This type of lap can be rotated in a drilling machine and applied to the end of the push rod held in the vice using grinding paste.

To make a suitable lap for a push rod socket a steel ball should be softened by heating to red and allowing to cool out slowly. A flat should then be filed and a groove hacksawed to take a driving rod rotated in a drilling machine. As the grinding paste loses its cutting power it should be washed off with kerosene and fresh paste applied. All parts should be scrupulously cleaned at the finish, not forgetting to brush out the teeth of the gears particularly well.

Trouble with the big-end or main bearings involves separating the halves of the crankcase. The best way of doing this, when all the bolts have been removed, is to pull with the hands at the crankcase mouth, or, if the spigot joint is very tight, to tap in the crankcase mouth with the end of a wood handle, such as that of a hammer. Afterwards, the halves can be worked to separate them. Provided there are no locating dowels, the halves can be rotated relatively to assist the separation.

This method is useful when ball bearings are used for the main journals and the shaft is tight. A grip can then be obtained on the jointing faces of some of the lugs; and if an assistant taps the end of the crankshaft with a soft hammer or mallet, the half will come away easily. Alternatively it is helpful to lift the crankcase by the lugs of one half, and hold it just supported on a pad of rags on the bench. The assistant can then tap the shaft downwards, and as the crankcase half comes away the other half will fall gently on the pad.

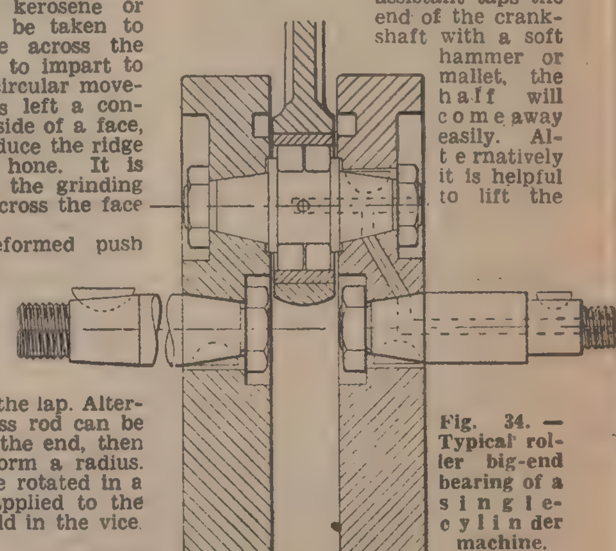


Fig. 34.—Typical roller big-end bearing of a single-cylinder machine.

CHECKING BIG-END WEAR

The big-end bearing of the usual motor-cycle engine is a narrow roller type, on which to check wear accur-

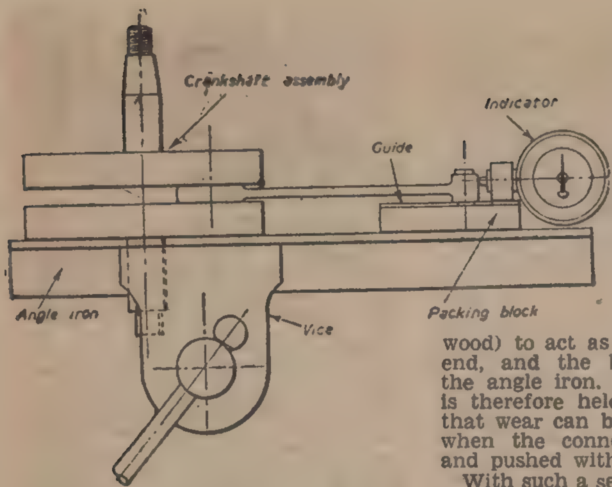


Fig. 35.—Useful jig for checking wear in big-end bearings.

ately a jig or set-up is required in order that the issue shall not be confused by rock or side play. This is in contradistinction to the metalled bearing employed on car engines, on which the bearing grip can be such that the connecting rod falls

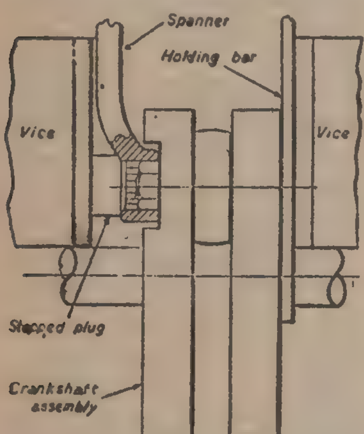


Fig. 38.—Useful way of preventing the spanner riding off the crankpin nut.

through a certain arc, or on which the clearance can be checked with a strip of plastic material compressed in the bearing. Considerable sideways rock on such a bearing would indicate a defect, whereas similar movement in the case of a motorcycle engine is acceptable within limits. This is because the bearing is a "hard" type. A typical example appears in Fig. 34.

With the crankshaft assembly removed, however, the big-end bearing can be accurately checked on a set-up of the type shown in Figs. 35 and 36 for the extent of wear to be shown on an indicator or obtained with feeler gauges. The crankshaft assembly is laid vertically on the vice between two pieces of angle iron, with a piece of cardboard wrapped round the mainshaft so that the whole can be gripped without damage. The connecting rod is situated at T.D.C., and the small end supported on a packing block, which should be of such a thickness that the side play or rock is halved; that is, the connecting rod is supported in its normal central position.

Pieces of thin metal are screwed to the block (which can be of wood) to act as guides for the small end, and the block is clamped to the angle iron. The connecting rod is therefore held in such a manner that wear can be accurately checked when the connecting rod is pulled and pushed with the fingers.

With such a set-up almost any type of indicator can be employed, the clamping details being arranged from the wood packing block or from the angle iron. Alternatively, a small block of metal can be screwed to the wood, and this packing piece then clamped with the connecting rod pulled up and the top end in contact with the metal block. Pushing the connecting rod down will then leave a gap should there be any wear, and the extent of the gap can be checked with feeler gauges. Should the top of the connecting rod be rough it should be smoothed with a file for this test.

Having checked at T.D.C., as in Fig. 35, the assembly should then be changed to check the wear at its maximum position, where thrust is applied to the crankpin during the firing stroke, Fig. 36. It will be found in some instances that wear varies considerably at different positions on the crankpin. To make these tests, it is necessary, of course, to wash the big-end in clean kerosene or remove oil by squirting kerosene through the crankshaft. Provided wear does not exceed .003in., the bearing need not be renewed.

DISMANTLING CRANKSHAFT

The typical crankshaft in Fig. 34 depicts the main features of the type. The crankpin is fitted through tapers in the flywheels, and the timing side is often located with a key where there is a direct oil feed to obviate the chance of incorrect assembly and the oil feed hole being blocked. The opposite side may be plain to admit of lining up the assembly.

The big-end rollers, of which there may be two groups, are contained between flanges on the crankpin, and the connecting rod and outer sleeve of the bearing are located by the flywheel faces, or on occasion by washers. The mainshafts are fitted by tapers similar to the big-end, and these are usually keyed—the one to ensure accurate timing, the other to transmit the drive.

There are variations from this arrangement, one of the most notable being the B.S.A. Bantam engine, where the crankpin and mainshafts are a press fit in parallel diameters in the flywheels.

While dismantling the crankshaft is not essentially difficult it can involve some snags for the partially experienced mechanic, and particularly when the correct service tools are not available. The assembly is not too easy to hold for no damage to be done to it, unless some method like that shown in Fig. 37 is adopted. It is recommended that a piece of steel plate ¾in. thick should be clamped up to the flywheel using a steel distance piece and one of the crankshaft nuts and washers. This

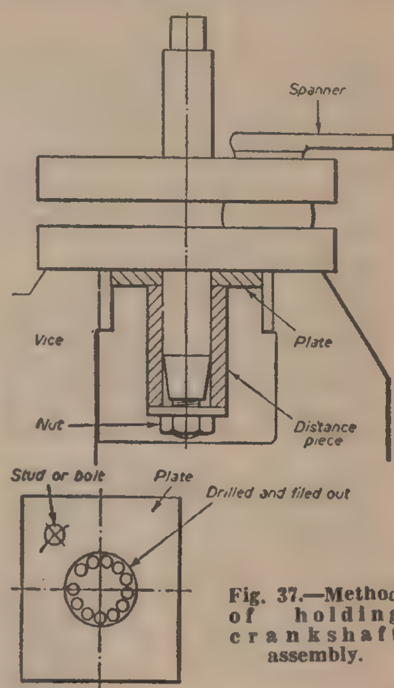


Fig. 37.—Method of holding crankshaft assembly.

plate should be provided with a stud or bolt to engage with the boss of the crankpin and prevent rotation. The assembly is thus very firmly held for the crankpin nut to be undone with a spanner. If the big-end is only to be examined, the timing side can be undone, then the key will provide

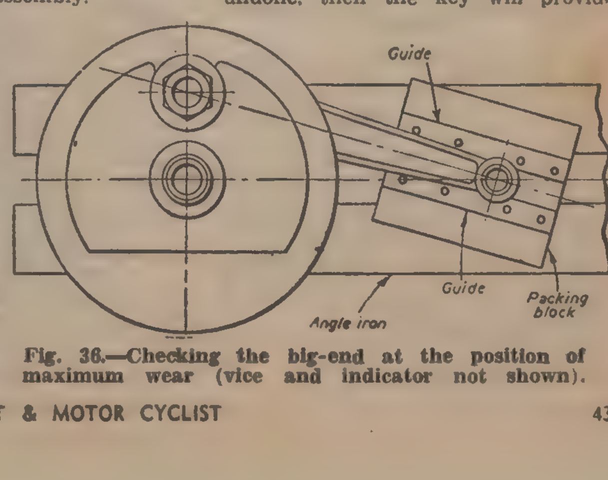


Fig. 36.—Checking the big-end at the position of maximum wear (vice and indicator not shown).

location for reassembly—in conjunction with a check.

The hole in the steel plate can be produced by drilling a circle of small holes, chiselling the metal away between, then filing to size, while the distance piece can be a piece of water pipe, cut off with a hacksaw and filed reasonably square. Should the crankpin nut prove too tight for any available spanner, it should not be chiselled, though it can be loosened with a hammer and a square-ended punch resembling a very blunt chisel, applied against one corner.

Ring spanners of the usual type are often thought to be unsuitable for crankpin nuts, owing to the shallowness of these, and the fact that the spanner handle is off-set from the head, this causing it to ride off. This defect can be overcome, however, as shown in Fig. 38, gripping the crankshaft assembly in the vice. A holding bar should be made in material about 2in. x 3/16in. section, on the lines of the plate in Fig. 37, leaving a length to obtain leverage. Then a plug which should preferably be stepped, but which may be merely chamfered with a file, should be applied to the spanner. The assembly should be gripped moderately tightly in the vice with the holding bar engaging and the spanner operated or tapped with a hammer.

SEPARATING FLYWHEELS

When an assistant is available the assembly can generally be separated by means of a hammer and soft punch—in copper or aluminium. The crankpin nut is undone back flush with the end of the crankpin, and the assembly held vertically by one flywheel. The punch is then applied to the crankpin and tapped with the hammer—a good blow often being required. No damage should be done to the nut or the crankpin in this way.

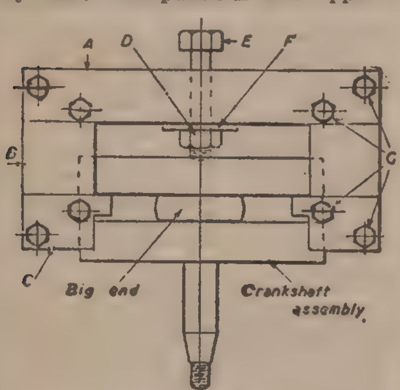


Fig. 39.—Easily made special cramp for dismantling the crankshaft assembly.

Should the crankpin be short so that the nut overlaps the end when undone, the nut should be completely removed, the flywheels tied together and the assembly supported by the upper wheel above a pad of rags on the bench. When the assembly separates the bottom wheel will not then fall any distance.

When you employ this method care must be taken not to burr the thread on the crankpin.

CRANKPIN CLAMP

A suitable cramp can easily be made for separating flywheels by anyone having means of drilling ⅜in. holes in steel. The device is shown in Fig. 39. The pieces A are 1½in. x ⅜in. mild steel, two in number; the pieces B, 2in. x 5/16in., four in number (two each side); and the pieces C, 1½in. x ⅜in., four in number (two each side). The nut and bolt, D and E, are ⅝in. B.S.F. The plate F is 3/16in. thick, and the bolts G are ⅜in. B.S.F. The plates B are bolted between the pieces A and the pieces C. The cramp is operated by holding the nut D and turning the bolt E.

The cramp should be made so that its length is the shortest practicable commensurate with the cramping bolt applying squarely to the crankpin, and maximum depth should be left on the pieces C which form the jaws where they fit between the flywheels.

BIG-END RENEWAL

Examination of the big-end when it has been removed reveals a grey track in the outer sleeve where the rollers have run; either side there may be the bright line of a ridge indicating wear, which can be felt with a fingernail. The crankpin may be a similar grey color, with pit marks in bad cases. The surface of the rollers is generally bright, with pitting evident in some instances. When wear is slight it is sometimes possible to reduce the effects by fitting oversize rollers; these, however, when supplied, are only a fraction of a thou larger, so wear must be small to admit of rectification. Because of the standard of precision demanded big-ends are only supplied complete — which often means the connecting rod as well, since the narrow outer sleeve must be pressed absolutely squarely into the big-end eye.

A check for squareness can be made on a surface plate, using a surface gauge and indicator. It should be verified by micrometer that the sleeve and big-end eye of the connecting rod are both parallel. The connecting rod is laid on the surface plate with the face of the sleeve making contact, then the indicator on the surface gauge should be run round the top surface of the big-end eye, when a steady reading should obtain, any variation indicating malalignment between the sleeve and the eye. This can be corrected by careful squeezing in a vice with packing pieces, followed by further checks.

Endplay on a big-end can be corrected in some instances by replaceable washers against the flywheel cheeks. The normal clearance is .008in. to .010in., rising on occasion to .015in. When insufficient clearance is present the big-end eye and outer sleeve should be carefully lapped or honed. This would only be necessary following the fitting of new thrust washers when a check has been made.

REASSEMBLING FLYWHEELS

Scrupulous care is essential in assembling the flywheels to ensure that the tapers are perfectly clean and dry to pull home absolutely tight. It is usual to fit the timing side of the crankpin first, pull this as tight as possible and finish it. The flywheel may either be gripped flat in the vice at the bottom (with cardboard packing) or a set-up similar to that in Fig. 38 can be adopted, with a soft pad at the end of the crankpin. The big-end rollers can be assembled with the crankpin in a vertical attitude being held in place with vaseline until the connecting rod can be fitted.

A rough check of alignment is made as in Fig. 40 when the driving side flywheel is fitted. The crankpin nut should be pulled fairly tight, and a straight-edge placed across the two flywheels to test parallelism.

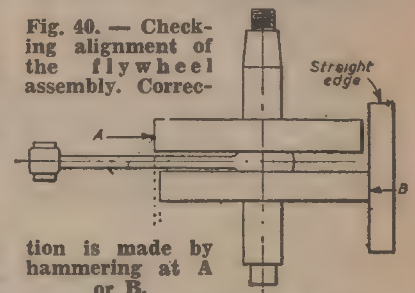


Fig. 40. — Checking alignment of the flywheel assembly. Correction is made by hammering at A or B.

The assembly is almost always malaligned at the first check, and correction must be made by striking with a soft hammer or mallet at A or B, Fig. 40. When the straight-edge lies flat across the two wheels the crankpin nut can be tightened—but not fully until a further check has been made, for the act of tightening the nut will often upset the flywheel alignment. A considerable number of attempts may have to be made before the assembly is both fully tightened and true. This method of testing, while often employed, is only approximate, and to be sure that the shaft is as true as possible a jig of the type shown in Fig. 41 should be constructed, the shafts and flywheels then being tested by indicator at the points marked X.

This jig can easily be constructed from 2in. x ¼in. angle iron bolted to a board which can be held in the vice. The top ends of the two pieces of angle iron should be provided with vees, cut with a hacksaw and filed

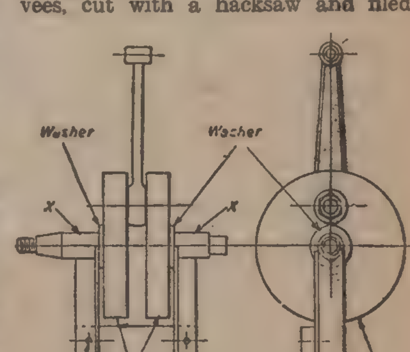
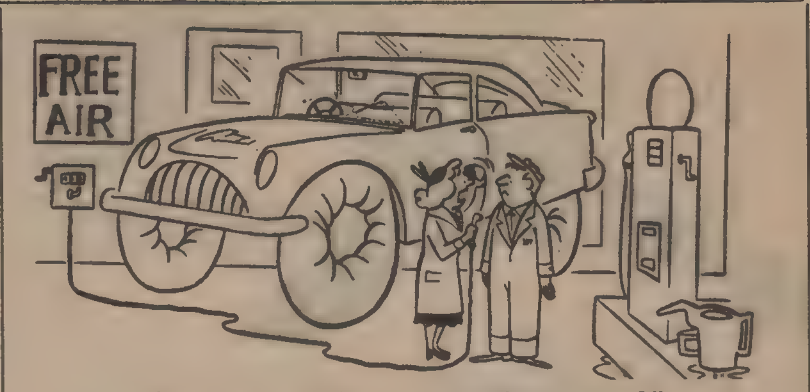


Fig. 41.—Simple jig for testing the crankshaft assembly. Check at points marked "X."

with the two pieces of iron clamped together in the vice. The spacing when attached to the board should be such that a washer can be placed either side of the assembly. If the bench has a flat board front, as many have, the angle iron test pieces can, of course, be temporarily bolted direct.

Correction of the flywheel assembly is made as in Fig. 40, with blows on the flywheels at 90 degrees to the crankpin position—the crankshaft, of course, being lifted from the testing jig. Flywheels which are pressed on to the crankpin require a special jib for assembling, and renewal work should be performed either by the manufacturers or an agent with suitable equipment.



"I saw the word 'free' and something snapped."

MAIN BEARINGS

Main bearings are advisedly checked for wear with an indicator before the crankshaft is removed from the crankcase, mounting the indicator for its foot to bear on the shaft, each end in turn, while a lever is used to induce up-and-down movement. In the early stages wear is distributed on the outer and inner members and the balls of a race. Where a heavy loading is carried local wear may be seen on the outer and inner members. On occasion this can be detected with a strong light if the race is thoroughly cleaned.

If the engine has been troubled by a deep periodic rumble a scarred ball may be suspected, and considerable testing may be necessary to bring this into an attitude to reveal slack on the race. It is often instructive to dismantle a defective ball race and examine the parts individually — although it cannot be used again.

Endplay on the crankshaft is generally taken up through shims on the driving side. A thick washer also being present, the correcting shims should be placed between this and the flywheel. Too little endplay can be corrected by carefully filing the washer, by lapping it or by rubbing it on a sheet of abrasive cloth laid on a surface plate. Endplay is usually about .010in., and the effect of fitting the driving shaft hub and sprocket should not be overlooked.

Should the main bearing races be loose in the crankcase the outsides can be plated, but to do this it is necessary to fit a good machined washer each side and put a bolt through the centre. An alternative method employed on occasion is to fit a strip of suitable shimstock in the housing round the ball race. A length is cut which will almost encircle the race and which is about half as wide again. This is laid in the housing, and the crankcase heated in boiling water, then quickly extracted, the ball race laid in and driven home. Steel shimstock should be used, and, properly fitted, it results in a satisfactory repair—particularly of older engines.

Axle Back Lash in pre-war Austins

● *Mechanic's guide to cause and cure*

IN the absence of hum or rumbling, indicative of tooth wear, and assuming, of course, that the hubs are tight on their tapers, back lash in the rear axles of some pre-war Austins (I refer, in particular, to the 1934 10 h.p. model), may be traced to wear of the two phosphor bronze washers which, situated on the differential spider, take the outward thrust of the small planet pinions (Fig. 1).

To renew these washers, the axle must be completely dismantled. This, however, owing to the accessibility of these older cars, is well within the scope of anyone with the minimum of garage equipment.

First, the rear of the car must be raised. Commencing with the offside, the axle is jacked up rather higher than usual, then lowered on to a set of wooden blocks positioned under the axle tube near to the spring, leaving the wheel just clear of the ground. The near side is then raised, and a further set of blocks placed under the side chassis member just forward of the spring shackle. A third set, under the off-side axle tube close to the differential casing, will give support when the latter is parted at this point. The jack should be allowed to remain under the near side tube. With the car supported in this manner, work may be commenced without fear of accident.

REMOVING WHEELS

The wheels should now be removed, followed by the brake drums (after extracting the countersunk retaining screws), and finally the hubs. In removing the hub nuts, a piece of stout gas barrel placed between one of the wheel studs and the ground will provide a solid resistance against which to apply full force to the spanner (Fig. 2). The hubs themselves are then withdrawn with an extractor. This tool may be purchased from those Austin dealers who sell spare parts for the older models, and is well worth the trifling cost.

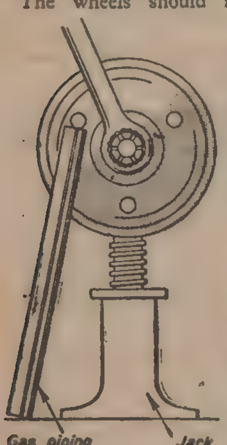


Fig. 2.—Removing the hub nuts.

BRAKE CABLE

Dealing with the near side only, the brake cable is now disconnected, and the shock absorber drawn off its two spigots by removing the four nuts; noting that the outer two lock the inner, which are tapered. Bending back their tab washers, the spring U-bolt nuts are removed and the bolts knocked out. This is followed by the withdrawal of the setscrews securing the two halves of the differential casing. These also have tab washers.

Grasping the axle tube at the hub end, the axle should be lifted until the locating "pip" on the spring plate is clear of its recess in the chair. The packing piece should be removed, and the parts kept separated by a small block of wood. This operation should have "broken" the joint at the differential casing. If it failed to do so, a stout knife with its edge in the joint and struck sharply on the back with a hammer will start the two halves.

DIFFERENTIAL CASING

Resistance to full separation will still be encountered due to the tightness of the ball races in their housings. A block of wood placed over the hub end of the off-side axle shaft, and struck with several hammer blows, will drive out the race on this side, when the casing will be free to part. Before doing this, the jack should be lowered and removed, leaving the near side of the car supported by the blocks under the chassis, as mentioned earlier. The removal of the jack will allow the spring to hang suspended by its shackles. Ample space is thus provided through which the half axle tube, together with the differential and shaft assembly, may be drawn clear.

With the parts on the garage floor, the block of wood and the hammer used as previously will free the remaining ball race, when the differential may be withdrawn and cleaned with kerosene for inspection.

TEST FOR END PLAY

Gripping the near side shaft in the vice, a screwdriver should be passed through one of the lubrication holes in the differential housing, and the small pinions checked for end play. If this is apparent, the thrust washers are due for renewal.

Before parting the housing, which is effected by withdrawing the six bolts (again noting the tab washers), the halves and shafts may be marked with a file, to dispel any later doubts with regard to correct replacement.

At this stage, the shaft bearing bushes and the ball thrust races should be examined for wear. The latter may be checked by gripping the outer rings and pressing inwards with a semi-rotary movement. If roughness is felt, they should be renewed.

Viewing the housing from the inside, two small diametrically opposed holes will be observed, through which a punch may be passed and the ball race driven off.

These races (the near side one in particular), in addition to carrying the running load of the differential, receive the powerful side thrust. They are, therefore, of the deep groove type; and it is of the utmost importance that they should be fitted with the deep side of the ring groove facing outwards.

REASSEMBLY

With the shafts replaced in the housings, and the phosphor bronze washers in position, the differential should be assembled, using all six bolts, and the parts tested for freedom of rotation. If any stiffness is experienced, it should be again dismantled, and the thickness of the washers slightly reduced by rubbing them face downwards on a flat file held in the vice. A further trial should be made and this process repeated, if necessary, until there is full freedom of movement, with no end play, but with the slightest detectable shake between the pinion teeth (this latter for oil clearance), when the differential may be finally bolted up, using new tab washers.

The general reassembly in the chassis is a reversal of the dismantling procedure. Three points, however, are worthy of mention.

The differential casing meets in a registered joint; there is, therefore, no need for a paper washer. To deal with small irregularities in the metal, a smear of nothing more viscous than gold size may be applied to the surfaces. Incidentally, the squeezing out of the size around the circumference of the joint will indicate that it has been evenly and tightly drawn together.

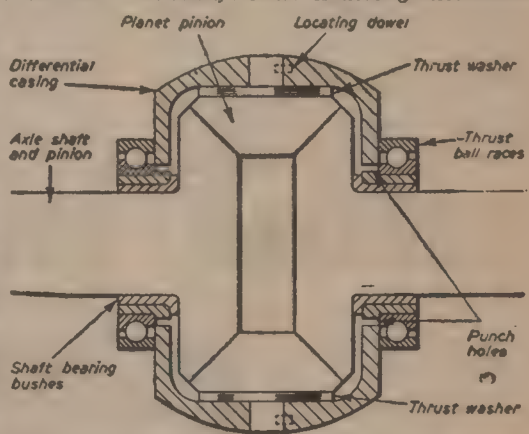


Fig. 1.—Showing the position of the two phosphor bronze washers.

ALIGNING SPOT PIN SLOT

On fully tightening the castellated hub nut (again bringing into service the length of gas barrel), it will probably be found that the split pin slot does not register with the hole in the shaft. On no account should the nut be turned back in order to effect alignment. It should be again removed, taken to the vice, and the back faced off with a file. The aim must be, that, with the nut dead tight, easy passage of a 5/32in. split pin is obtained.

The third point concerns the replacement of the countersunk brake drum retaining screws. It is sometimes thought necessary that these should be knocked up with a punch, and centre punched as an added precaution. Their purpose is merely to ensure that the drum remains in position when the wheel is removed for any reason. Normal screwdriver manipulation is all that is needed. Full security, of course, is provided by the wheel nuts.

MAGDYNAMO UNITS

MANY British motor cycles are fitted with the magneto and dynamo combined into one unit. This arrangement reduces overall size—an important consideration for the motor cycle manufacturer. The magdynamo unit is a vital component and as such should be regularly checked at least once a year.

The magneto part of the unit is driven from the engine crankshaft by either chain and sprocket or a gear train. A clutch drive assembly is arranged on the end of the magneto armature shaft and the dynamo is driven from a fibre gear via the clutch assembly. This type of drive is used as a protection for the magneto. In the event of partial or total seizure of the dynamo armature—an occurrence not unknown—the clutch slips, allowing the magneto armature to revolve without damage. If a direct drive were fitted, a fault in the dynamo unit might well put the magneto out of action, consequently immobilising the machine.

Removing the magdynamo unit, a general view of which appears in Fig. 1, is usually a fairly straightforward task, although on some machines the unit is not always as accessible as it might be. Once off the machine the unit can be thoroughly cleaned externally with petrol and a small brush. External cleaning makes for easier handling.

Many motor cycles have magneto and generator (or dynamo) combined. Here's how you service this unit

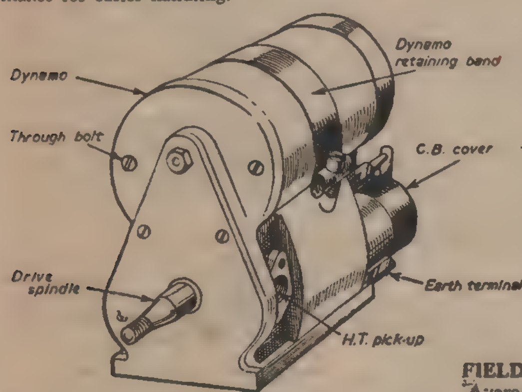


Fig. 1.—General view of magdynamo unit.

To split the unit into its two main components the front retaining screw and the circular strap must be removed. The dynamo part can then be slid out of the magneto housing.

OVERHAULING DYNAMO

Lift the brushes and remove the two through-bolts. Tap the commutator end of the armature spindle to jar the armature and drive the end bracket away from the dynamo carcase. The two-field coil leads can be disconnected to allow the commutator end bracket to be withdrawn. Removing the armature from the drive end bracket may require the aid of a small screw-press, but it is often possible to utilise a pair of screwdrivers to prise off the armature drive gear, which is retained by a small bolt and lock washer. After the armature has been removed from the drive end bracket the three screws which retain the bearing cover plate can be unscrewed and the plate removed, exposing the roller race. This race should be thoroughly cleaned in petrol and all traces of grit, etc., removed before repacking with a high melting point grease.

The other components of the dynamo unit should also be washed in petrol. It is important to clean all traces of grease from the carcase, as clearance between the armature and field pole shoe is extremely small in these dynamos.

FIELD COIL TESTS

Average resistance in ohms of the dynamo unit is 2.8 to 3.0

If a resistance meter is not available the field coil should be checked, using a testlamp and battery, as shown in Fig. 2. A headlamp bulb which consumes about 4 amps at 6 volt pressure should dim appreciably when connected in series with the field coil. If it does not, then the field coil may in all likelihood have short-circuited turns. This is usually not repairable and a replacement coil must be obtained. No light from the testlamp should be obtained when one side of the battery is connected to the dynamo yoke and the other connected to the ends of the field coil via the testlamp. If a light is obtained this will mean removing the coil for reinsulation.

Field coils are usually insulated with $\frac{1}{2}$in. width Egyptian cotton tape, a coat of quick-drying varnish being applied afterwards to seal the insulation. The old insulation must be completely removed before applying new tape. It is often advisable to renew the terminal ends of the coil while retaping for these ends may cause future trouble if left unattended. Flexible wire should be used to make these connections, as the existing field coil wire is too brittle to stand arduous wear. Solder the ends of two short lengths of cable to the ends of the field winding and sleeve the completed joint.

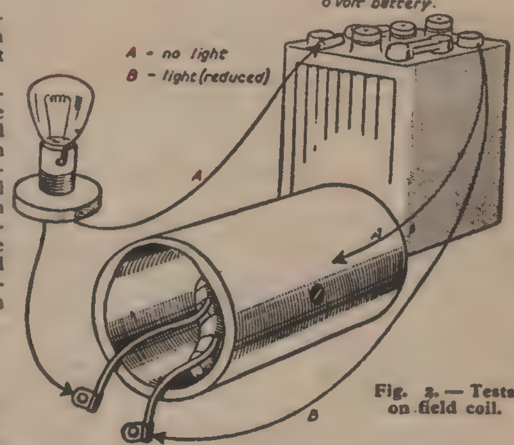


Fig. 2. — Tests on field coil.

ARMATURE TESTS

Three main faults are liable to affect the rotating armature: open-circuited windings; short-circuited windings; windings short circuited to the armature shaft.

Of these faults the most usual is the open circuit. An open-circuited armature develops "flats" on the commutator. Burning also occurs under the brush in operation so that the commutator segments become blackened.

The short-circuited armature is also often self evident. Armature windings become burnt around the general area of the short circuit, or the whole armature may look very black. These types of faults may produce the typical acrid smell of burnt insulation.

A short circuit to the *shaft* is not, however, often visible. It is usually necessary to make electrical tests to isolate this fault.

The testlamp and battery can be utilised to make tests on the armature windings for two of these faults. Connect the testlamp (fitted now with a *pilot lamp* bulb) in series with the armature commutator as shown in Fig. 3 to check for a suspected open circuit. The testlamp should not fluctuate unduly in brightness as adjacent seg-

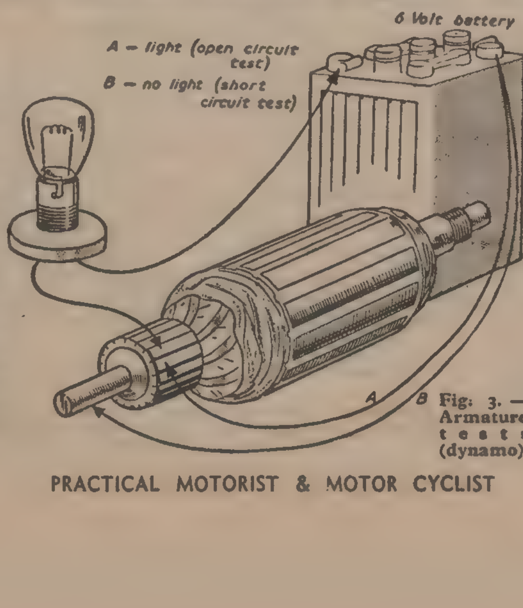


Fig. 3. — Armature tests (dynamo).

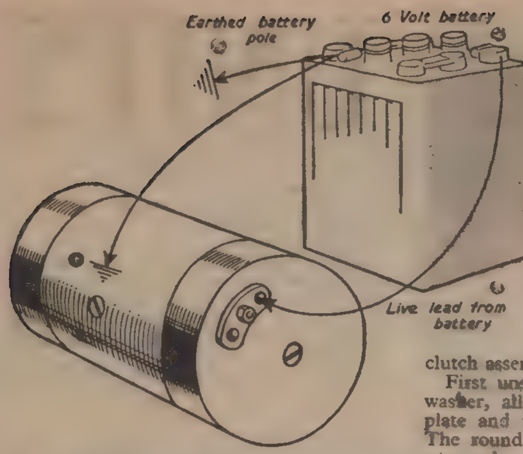


Fig. 4.—Polarising a m/c dynamo (machines made before 1951 were usually negative earth, after 1951 positive earth).

ments are tested. Any obvious dimming of the light will indicate a high-resistance or open-circuited armature coil.

Connect the testlamp as shown to test for insulation of windings from the armature shaft.

Any of the faults mentioned will necessitate a new or rewound armature, which can be obtained from a motor-cycle electrical agency.

If the armature survives these tests, then its commutator can be cleaned with a strip of fine sandpaper and the segments undercut. A piece of hacksaw blade should be ground thin enough to fit the mica grooves between the segments for undercutting purposes.

Bearings must be sound, especially the porous bush bearing fitted to the commutator end of the dynamo. Renew this bush if it looks at all worn. It is quite easy to press in a new bush, using a small mandrel made of an odd piece of steel.

When reassembling take care to connect the field coil ends to the correct terminals. One lead of the coil should go to earth (or the dynamo carcase), the other to the field terminal marked F. In most cases the field wire which should go to earth has a short length of sleeving fitted to it.

Brushes should be renewed if they are worn. If a new armature has been fitted they should in any case be bedded into the commutator.

The dynamo through-bolts should now be refitted. Ensure the armature does not rub the pole shoe. The end brackets will cause uneven armature rotation if they are not quite lined up, so watch this point. It may be necessary to *polarise* the dynamo after refitting. This is required whenever residual magnetism is lost from the field pole shoe. Simply connect a live lead from the battery, as shown in Fig. 4, to the dynamo terminal for a few seconds. Do not push the cut-out contacts together; this causes undue strain on the dynamo armature and may break the insulation down.

Remember that if the brushes are replaced in the wrong holders the dynamo will only charge in the reverse direction of rotation. If the dynamo fails to charge after being refitted to the machine, the fields should first be polarised, then the brushes changed over in their holders.

MAGNETO

It is essential to remove all inner projections from the magneto body before attempting to withdraw the armature. If any items, such as the earth brush, H.T. pick-up, safety spark gap screw, etc., are left in the magneto body, then damage will result to the armature slip ring as it is drawn from the magneto.

The clutch drive assembly is located on the drive end of the magneto armature and must be removed before the armature can be withdrawn. A special tool must be made up, as shown in Fig. 5. The tool can be easily bent into the required angle. It is then fitted into the hole already drilled in the clutch base for this purpose. The dynamo gear provides the location for the other end of the tool, and the base can then be held rigid for unscrewing or retightening the clutch assembly nut.

First unscrew the retaining nut and lock washer, allowing the clutch spring, driven plate and fibre drive gear to be removed. The round clutch base plate must now be removed. Unscrew the contact breaker assembly and C.B. end bracket, making sure all inner projections are removed, then invert the complete magneto body so that the drive end of the armature spindle faces downwards towards the bench. A wooden bench must be used. Tap the drive end of the armature gently on the wooden bench until it slides free of the clutch base and out of the magneto body.

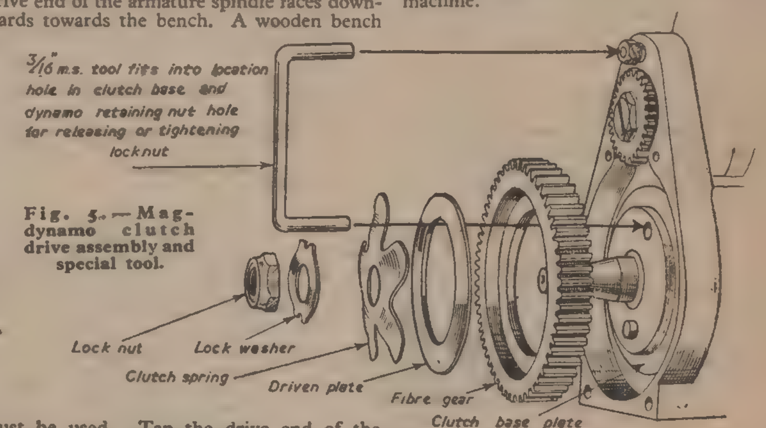


Fig. 5.—Magdynamo clutch drive assembly and special tool.

After withdrawing the armature the various components can be cleaned in petrol. Roller races are fitted to each end of the armature shaft, and these should be cleaned with special care. Repack each race with high-melting-point grease. The armature can be easily checked for efficient operation by testing as shown in Fig. 6.

It is wise to place a "keeper" of suitably sized iron inside the magneto body after cleaning to ensure that loss of magnetism does not occur while the rest of the magneto is being attended to. Clean the contact-breaker points with a fine carborundum stone used almost dry, and adjust them to .010in. when reassembling. Excessive end-play of the armature can be cured by fitting suitably sized shims between the slip ring and the inner bearing journal. A small press is essential to facilitate removal of the inner bearing journal when fitting these shims.

Final assembly of the magneto unit can be effected once everything has been cleaned and tested. Take care to assemble without using force. Magnetos are very susceptible to rough handling, and components such as the slip ring are liable to shatter if knocked accidentally.

The clutch drive unit should be fitted after the magneto itself has been assembled. Use the special tool to secure the clutch base, and screw the clutch-retaining nut down *tight*. Repack this clutch assembly with high-melting-point grease and screw the cover plate over the drive housing. This completes the magneto portion, and the magdynamo unit can be reassembled for final fitting to the machine.

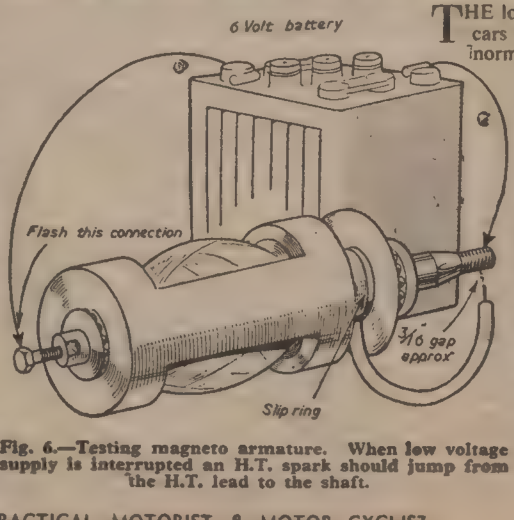


Fig. 6.—Testing magneto armature. When low voltage supply is interrupted an H.T. spark should jump from the H.T. lead to the shaft.

TIMING THE MAGNETO

Individual timings vary with each machine, but as a general rule the contact-breaker points should be just about to open in the retard position as the appropriate piston is at T.D.C. on the compression stroke.

GARAGING TIP

THE longer bodies on some of the newer cars make them a pretty tight fit in the normal-length garage, and owners find that garaging the car calls for "precision" driving so that the front end stays clear of the wall while there is still room to close the garage doors.

Here's a simple trick that will help you stop on the right spot every time. Tie a small rubber washer on a length of string and hang this from a convenient spot on the garage roof in such a way that when the car is correctly parked the washer just touches the windscreen. To position the string you'll have to park the car first by the trial and error method, but on all future occasions there'll be no fear of "overstepping the mark" when you drive in.

some way or other. A long box spanner will be found invaluable for the tightening, with the lower part of the stub gripped between a pair of pliers or similar tool. It may also be a good plan to smear the threads with gasket cement before applying the nut, thus making doubly sure of its security.

REPLACING AIR CLEANER

Before reinstalling the air-cleaner, the connecting tube should be attached to the jet stub and the supply tube, and the plastic container filled with an upper-cylinder lubricant. A test of the volume of discharge is made by holding a receptacle underneath the jet and gently squeezing the container until approximately $1\frac{1}{2}$ teaspoons of lubricant

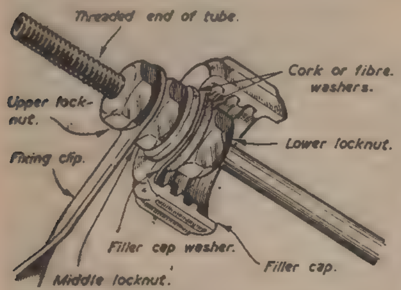


Fig. 4.—The assembly of the supply tube and filler cap.

have been ejected. This amount represents about 4 to 5 c.c., which is the advised quantity to use. The degree of pressure and also the time required should be carefully noted for future use. Usually, with a moderate pressure five to six seconds is sufficient, but the period of time naturally varies with the viscosity of the particular lubricant used.

The air-cleaner is now reinstalled and the oil container fixed into position, noting that the connecting tubing is free from any rubbing parts. With the container filled with U.C.L.

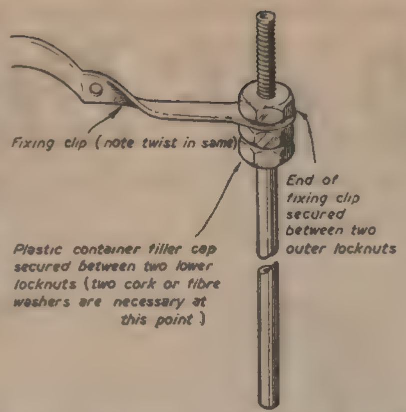


Fig. 5.—The location of the fixing clip upon supply tube. Note the twist in this. Alternative installation arrangements are, of course, possible.

the lubricator is then ready for use. Its method of operation is as follows: Immediately the engine fires it should be run fairly quickly and the upper cylinder lubricant injected by observing the identical pressure and period of time as required when making the initial test. In this respect, it would probably be more effective if the injection was split into two periods, the first immediately upon starting the engine, the second after one minute's running.

SUITABLE U.C.L.

As regards the use of a suitable U.C.L., there are many reliable makes on the market. You may prefer to use an additive in the U.C.L. in the form of colloidal graphite. The proportions used are ¼ oz. of graphite to 20 fluid ounces of lubricant, and the results attained certainly seem to justify the experiment. Graphite, as most readers know, possesses quite unusual lubricative properties, being unaffected by the flame heat or frictional pressures. The surface of a cylinder-bore, even the most perfectly run-in, is, in fact, composed of microscopic hills and dales, very similar, in fact, to that of a sponge. The formation of a graphited surface is slowly accumulative, it is not dispersed like an oil film, and the action is to fill the sponge-like cavities with graphite thus presenting a smooth and practically self-lubricated surface. This surface being impregnated with graphite lasts many thousands of miles in this condition without a further deposit of graphite being required. In fact, the writer has known instances of new engines being run-in on a graphited compound for 500 miles or so, and traces of graphite have still been evident on the bores under microscope examination after a period of 15,000 miles so the addition of graphite to the U.C.L. is worthy of very serious consideration if the utmost bore life is required.

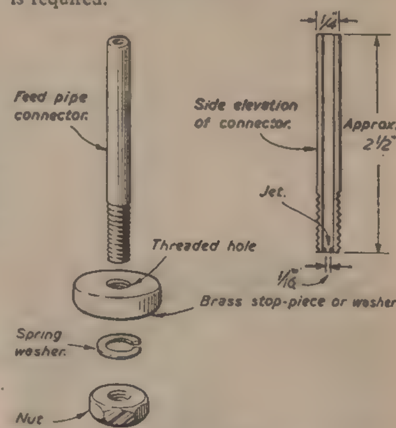


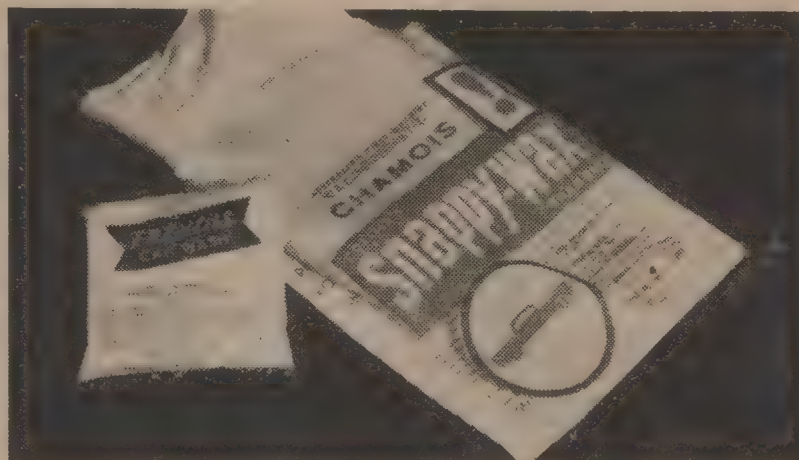
Fig. 6.—Constructional details and order of assembly for the oil ejector jet.

INDEX TO PREVIOUS ISSUES

Copies of past issues containing the following articles are obtainable at 2/- each plus 3d. postage from Practical Motorist & Motor Cyclist, 5th Floor, 19 Bridge Street, Sydney:

HEARD OF THESE?

● *What's new in accessories and equipment*



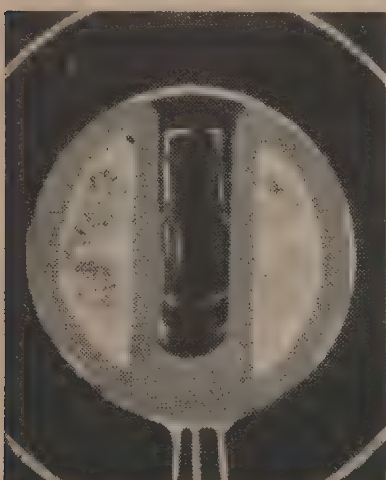
QUICK-ACTING DETERGENT

If your car is extra dirty try Freydis Car Wash next time you clean it. Freydis is a highly concentrated detergent powder that dissolves readily in tepid water. A packet containing enough powder to wash a big car twice costs 1/6.

First hose the car down with clean water to remove excess grit and mud, next clean off caked-on grime by sponging liberally with the Freydis solution, then give a final thorough hosing down and dry off. It's important that the whole job be done in the shade.

KEYHOLE LIGHT

A gadget to save you fumbling with car keys at night time is Car-Key-Lite. This is a non-electric



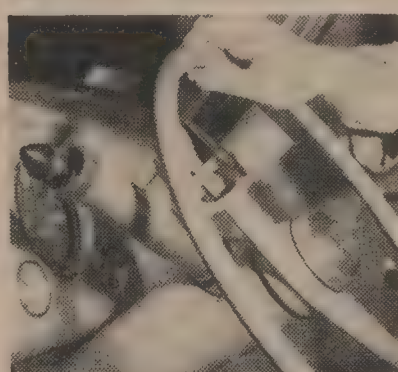
luminous disc that you simply glue on to the lock round the keyhole. Suitable for either ignition or door locks, Car-Key-Lite is made by Radium Light Co. and sells through garages and hardware stores at 5/6.

SPARK PLUG WITH UNBREAKABLE INSULATOR

The latest Vesta spark plugs are made with an "Aluminox" insulator that is guaranteed unbreakable. The Vesta Company is so sure about this that if an insulator cracks or breaks within one year of normal service, the plug will be replaced free. Another worthwhile feature is the cadmium-plated steel body which is proof against rust both on your garageman's shelf and in service in your car. Vesta plugs are made to suit all makes of vehicle.

AGAINST CAR THIEVES

For cars with steering-column gear change the Sta-Put Steering Lock is an effective anti-theft device. It can be applied and removed in seconds. When the rubber-lined cylinder is slipped over the gear handle a bracket passes over one of the spokes of the steering wheel and is held by a strong padlock, thus immobilising the gears.



Since the lock is made of case-hardened steel it will defy any attempts at dismantling by sawing or filing.

Priced at 59/-, Sta-Put is made by K.F.M. Industries in types to fit a wide range of British and American cars. Your garage or hardware shop should be able to supply you.

WAX-IMPREGNATED CHAMOIS

A chamois that washes and waxes your car at the same time is Snappy-Wax, distributed by Graham Collier Pty. Ltd. through garages and hardware stores (price, 25/6).

You wash the car with it as you would with an ordinary chamois, but don't use detergents in the water. As you wipe dry with the Snappy-Wax it spreads a film of wax over the surface, which is then polished off with a soft cloth. The chamois is guaranteed for over 45 waxings. Our test showed that it gives a good lustre.

All prices quoted are for Sydney. They may vary slightly in other places.

GREASE COVERS FOR TOWBARS

Every motorist with a towbar attached to his vehicle knows how easy it is for clothes to collect grease spots from the coupling ball. You can try covering it with half a tennis ball or a piece of rag, but a much neater job is the special rubber cap illustrated here.

Made by Carapark Productions Ltd., the caps are available to fit coupling balls of $1\frac{7}{8}$in., 2in., and $2\frac{1}{4}$in. diameter. and sell for somewhere between four and five shillings.

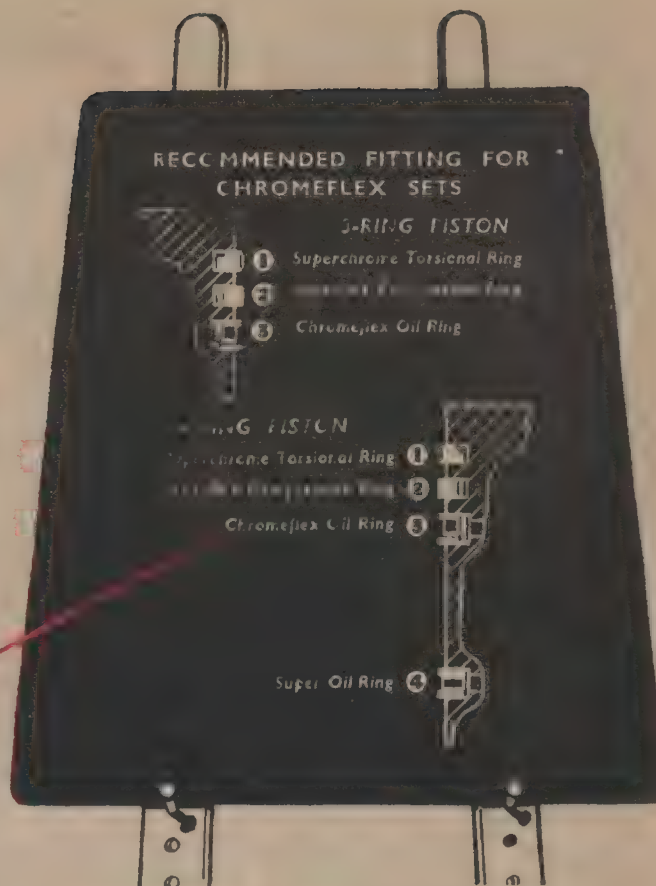
HERE'S HOW TO FIT

POLSON

CHROMEFLEX

TRIPLE PURPOSE RE-RING SETS

TO IMPROVE
THE PERFORMANCE
OF TRUCK, BUS AND
CAR ENGINES..



The diagram shows the recommended fittings for Chromeflex Sets. Each Chromeflex Set is designed to provide the most efficient combination of rings for the particular application. Full fitting instructions are included with each pack, together with a gauge for easy measuring of the ring grooves.

LONGER LIFE: Superchrome torsional ring for top groove reduces wear and increases resistance to heat and scuffing.

POSITIVE OIL CONTROL: Chromeflex oil control ring has two chromed steel segments and new rigid type steel spacer for maximum oil flow.

EASY FITTING: For most popular engines no additional machining or regrooving is required.

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Available from all leading wholesalers.

PP71

MOTOR-CYCLE

THERE are some who maintain that motor-cycle design has been stagnating for many years. The followers of this creed point out that each loudly hailed "new development" has been tried before, usually a quarter-century or more ago.

This argument is applied particularly to wheel suspension, since practically every present-day variety of front- or rear-wheel springing has its counterpart in earlier motor-cycling history. All very true so far as it goes, but it does not go far enough. What the "stagnation" fans forget is that at that time motor-cycling technology was far less advanced and the field for research was unlimited.

From the early welter of suspension ideas matters had become fairly stable by the middle 'twenties, by which period the rigid frame and girder front fork had become by far the most widely used combination. This situation persisted for more than a decade. There were isolated examples of sprung rear wheels, such as the Vincent H.R.D. (as it then was), but, in general, motor-cyclists were satisfied with the standard of steering, roadholding and comfort afforded by the rigid frame.

RACING

As in many other aspects of motorcycle design, racing was the forcing house of improved suspension. The performance of racing engines advanced so rapidly during the 'thirties that it outstripped the handling qualities of the frames. Springing of the rear wheel thus made itself a necessity for the racing mount.

In the last year or two before the war quite a number of production machines with sprung rear wheels became available. Most of these had the so-called plunger pattern of springing. In its basic form this consists of two near-vertical spring boxes attached to the rear of the frame, the wheel being carried between spring-loaded plungers which move on guide rods within the boxes. This system was probably the first to be adopted in any quantity because it looked much like a rigid frame and necessitated comparatively little modification to an existing structure.

PLUNGER SPRINGING

Plunger springing is simple and has low unsprung weight, so that the wheel assembly offers little inherent resistance to following road undulations. However, it has the major disadvantage that the straight-line motion of the wheel causes the chain to tighten as the wheel departs in either direction from its mid position. To avoid overtightening the chain at the extremes of travel, the movement has therefore to be limited to 2in. or less. A second snag is that lateral rigidity—so essential for safe high-speed handling—depends on the stiffness of the rear wheel spindle and the maintenance of close clearance between plungers and guide rods. Also, chain pull tends to increase the friction between plunger and guide, thus amplifying the wear rate of these parts. Finally, the layout does not lend itself readily to built-in damping.

Two firms, Ariel and Triumph, have provided answers to the problem of varying chain tension. Ariel did so by a linkage system which caused the wheel to move in an arc round the centre of the gearbox sprocket: Triumph evolved a spring hub of very neat appearance in which curved guides were used to give the desired arcuate path. Although the designs are ingenious, both are in the process of being superseded. The conventional plunger layout became very popular during the earlier post-war years, and was undoubtedly a big improvement over the rigid frame. Within the last two or three years, however, there has been a strong trend away from it towards the pivoted-fork method which is now the dominant one both in Britain and on the Continent.

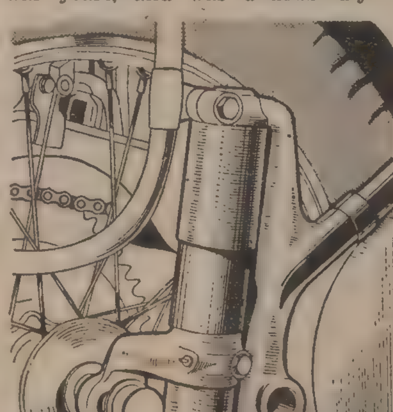


Fig. 1.—B.S.A. Golden Flash—plunger rear suspension for sidecar work.

PIVOTED-FORK SUSPENSION

While there are considerable variations between one make and another in the detail points of design, almost all pivoted-fork suspensions have the fork pivoting from the main frame immediately behind the gearbox. The wheel spindle is carried between the rear extremities of the fork, which may be of brazed-up or welded construction or be fabricated from pressings. On certain Continental machines a swinging arm replaces the fork, and the wheel is fitted on a stub axle, a system which greatly facilitates wheel removal.

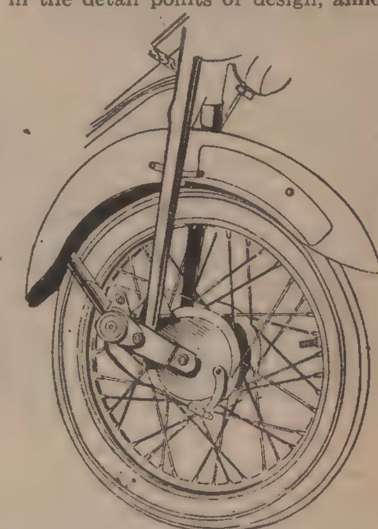


Fig. 2.—British Greeves leading-link front fork with rubber-in-torsion springing and adjustable friction dampers.

The most common springing medium is the telescopic strut which combines coil springs with hydraulic damping. Also used are steel torsion bars or rubber in tension, compression or torsion. Rubber has energy-absorbing properties which make it largely self-damping, so that it offers a simple form of suspension particularly well suited to the lower-priced motor-cycle. Telescopic shock-absorber struts are usually mounted between the outer ends of the fork arms and a rearward extension of the frame but, with the general cleaning-up of design which is now apparent, the attachment of the upper ends of the legs directly to an internally stiffened mudguard or rear fairing is becoming increasingly popular.

TORSION BARS

Torsion bars and rubber springing are frequently actuated indirectly by

SUSPENSION SYSTEMS

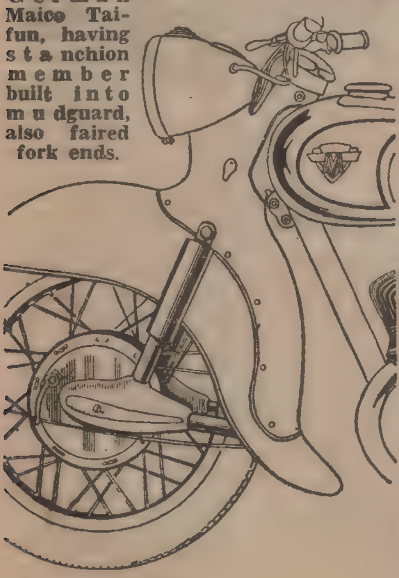
● ***Types of front- and rear-wheel springing on British and Continental models — their relative advantages***

a linkage from the fork because the movement involved is less than that of the rear spindle. The spring units may be located above or in front of the fork pivot, or even beneath the gearbox. On the Greeves, a British luxury lightweight, rubber-in-torsion units are mounted high on each side of the rear wheel and are connected to the fork by rubber-bushed links. On some machines the pivot spindle is fixed in the main frame and the bearings are in the fork, while on others the spindle oscillates with the fork in bearings in the frame. The most common bearing materials are bronze, light alloy and rubber, while Vincents remain faithful to taper-roller bearings on their triangulated pivoted-frame layout.

Provided that the fork and its supporting structure are adequately sturdy, pivoted-fork suspension provides good lateral rigidity which is less dependent on rear-spindle strength than is the plunger system. Unsprung weight of the pivoted-fork assembly is the greater of the two, but the difference does not appear to be significant. Where the pivoted fork scores heavily is in the relatively small variation in chain tension which occurs with wheel movement. Since the wheel moves on an arc rather smaller than that of the gearbox sprocket, the chain slackens a little towards the extremes, but the tension variation is such that travels of 4in. or more are possible without the chain jumping the sprocket.

Any springing system has a natural frequency of vibration and, on being deflected, will continue to oscillate about its mean position unless damped. Such oscillation can cause pitching of a motor-cycle, especially if the front and rear suspensions have similar frequencies or if one frequency is a multiple of the other. The inherent damping quality of rubber has already been mentioned, but steel springs require an additional damper to give the best results.

Fig. 3. — Earles-type front fork on German Maico Taifun, having stanchion member built into mudguard, also faired fork ends.



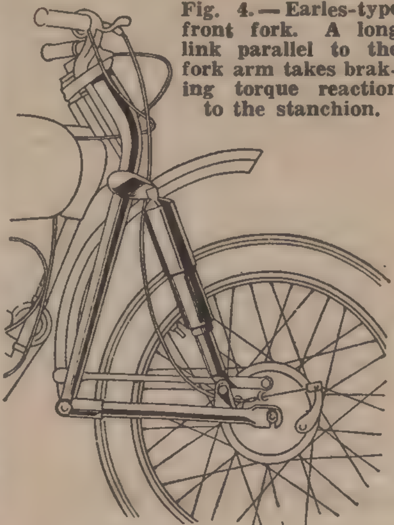


Fig. 4. — Earles-type front fork. A long link parallel to the fork arm takes braking torque reaction to the stanchion.

The earlier friction type of damper was insensitive to small road shocks because of its considerable static friction, and has largely given way to the hydraulic pattern which has more suitable characteristics for motorcycle use. In the hydraulic damper, wheel movement displaces oil through orifices, the size of which governs the rate of displacement and hence the degree of damping. By suitably arranging the orifices and non-return valves in the damper it can be made to provide a heavier damping of rebound than of shock movement so that pitching is virtually eliminated. With a motor-cycle considerable variations in loading are possible, and in consequence a non-adjustable suspension must be too stiff when lightly loaded if it is to deal adequately with heavy loads. It follows that some means of adjustment can do much to aid riding comfort; such adjustment is the latest development in pivoted-fork rear-wheel springing.

METHODS OF ADJUSTMENT

Several methods of adjustment are employed: the rating of the springs or their degree of pre-loading may be variable, or one end of the legs may have a slotted mounting to permit alteration of either the angle of attack or the leverage to suit the conditions of use. On certain Continental shock-absorbers the damping strength can be altered without adjustment of the spring. Each of these methods is beneficial though not all provide as large an adjustment range as is really desirable, and there is still plenty of scope for development.

The fact that so much intensive work has been done on rear suspension should not blind one to the progress made in front forks during the period under review. In the late 'thirties the girder fork, with its "parallel-ruler" action and central coil spring, was almost universal. Only in the racing sphere were there signs of a revolution when the established B.M.W. hydraulically damped telescopic fork was joined by a Norton product of somewhat similar design. Good lateral rigidity and resistance to damage are provided by the girder fork, but it has the disadvantages of rather restricted wheel movement and, towards the limits of travel, excessive variation of trail and wheelbase. Trail variation tends to result in uncertain handling on bumpy surfaces, while that of wheelbase, by constantly accelerating and decelerating the front wheel, promotes rapid tyre wear at high speeds.

TELESCOPIC FORK

The telescopic fork has a self-explanatory name and its design offers virtually no restriction to wheel travel, as much as 6in. being obtainable in some instances. Unsprung weight, though not very low, is in general rather below that of the girder type though the total weight is greater. The geometry is superior to the girder fork in that trail and wheelbase variations are relatively small throughout the range

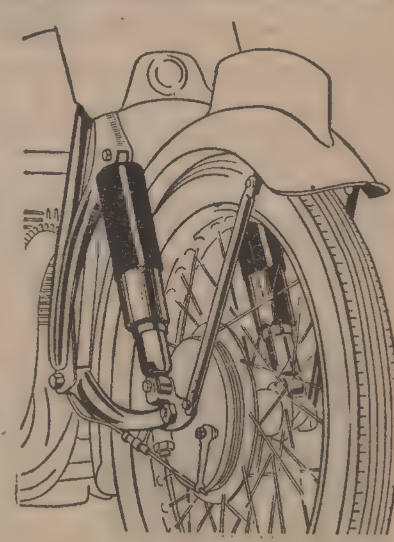


Fig. 5.—An Earles layout which did not go into production — the Ariel.

"It's not an ideal location, but we wanted a home near his work."

of movement. Such forks are, however, rather susceptible to damage since they rely on accurate alignment for freedom of action.

Pioneered by Matchless on production machines during the war, the telescopic design was quickly taken up by other manufacturers thereafter and by 1952 the fork occupied much the same position of popularity as did the girder pattern in 1939. In addition to its longer travel and better geometry, the telescopic fork leads the girder fork through lending itself to the incorporation of hydraulic instead of friction damping.

BOTTOM-LINK PATTERN

Within the past year or so fairly strong competition has been offered to the telescopic fork by the bottom-link pattern, in which the wheel is carried between links (or within a fork) pivoted on the lower end of stanchions attached to the steering head. Such forks may be subdivided into leading-link and trailing-link layouts; the former has the wheel spindle ahead of the pivot axis and in the latter the spindle is to the rear. Both categories have their adherents, but those of the leading link are much the more numerous. Douglas and Moto-Guzzi have done much to popularise the leading-link fork having short, separate links and the springs and damping enclosed in the stanchions. The type has a longer travel than the girder fork, though the geometry is somewhat similar; unsprung weight is low, but the lateral rigidity depends largely on the wheel spindle, which must be robust for accurate wheel tracking.

From the rigidity and unsprung weight aspects the trailing-link fork is similar, but it possesses a less neat appearance and the geometry is much inferior. Since the wheel travels on an arc whose centre is outside the wheelbase, this last and the trail vary excessively with wheel movement.

THE EARLES FORK

Patented a few years ago by Ernie Earles, a Birmingham engineer, the pivoted-fork variant of leading-link front suspension is rapidly gaining popularity, particularly in Germany. In this design the wheel is mounted in a fork which pivots behind the wheel; the pivot is at approximately hub height. Telescopic legs provide the springing and lie one on each side of the wheel between the fork ends and base of steering head.

Since the radius of wheel movement is something like double that of the normal leading-link fork, the Earles layout gives smaller variations of trail and wheelbase and is probably the best of the current types in this respect. It can have a travel almost as long as that of a good telescopic fork, though its unsprung weight may be a little greater. The Earles fork has proved itself in racing on the "works" B.M.W. and MV-Agusta machines.

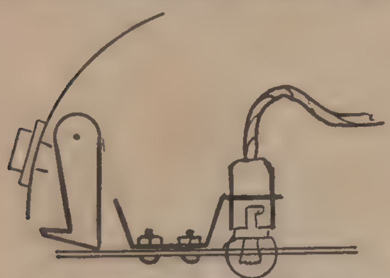
An article of this length can deal only briefly with some of the many facets of motor-cycle suspension; nevertheless, it is possible to draw four major conclusions. Pivoted-fork rear springing has become the dominant type; suspension adjustment, at least for the rear wheel, is clearly destined to become almost a standard feature; the bottom-link front fork—in particular the Earles design—is likely to increase in popularity at the expense of the telescopic; and, finally, hydraulic damping has effectively subdued its frictional competitor.

Here's a Good Idea!

• *Time and trouble-savers in the workshop and on the road*

GLOVEBOX LIGHT

HERE'S a simple way to fit a light to the glovebox of a Holden—and to other makes as well with slight modification. The glovebox catch acts as a switch for the light. Material needed is a three-quarter inch strip of thin sheet brass, a miniature single contact bayonet cap holder and a three or six watt bulb. Half of the bulb projects through a hole punched in the top of the fibre glovebox. The bulb holder is soldered into a hole in one end of the brass strip, which is bent to shape as shown. The bracket so formed is fastened by self-tapping screws to the top of the box and should be bent so that when the glovebox release button is pressed the catch touches the brass—earthing it and completing the circuit from the ammeter or any "live" spot under the dash to the bulb holder. The sketch explains the system. — A. Barnes, Dundas, N.S.W.



Method of fitting glovebox light.

STRING CLUTCH

I WAS a long way from home when the clutch on my motor-cycle burnt out. I dismantled it by the roadside and found it was of the cork insert type. I decided anything was better than being stranded, so used some strong thread, which I threaded through the holes, after pushing the cork out, to "reline" the plates. This got me home and allowed me to run round on the bike until I could get the proper inserts to reline the clutch properly.—R. Collier, Millswood Estate, S.A.

GASKET PATTERN

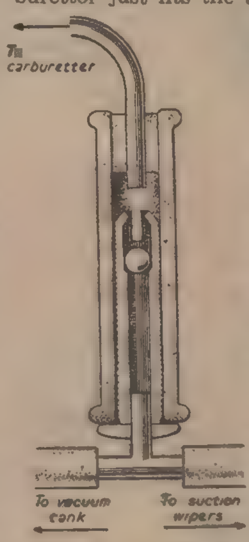
WHEN a new paper or cork gasket has to be cut, an accurate pattern can be obtained by placing a strip of the material over the surface to which it will be fitted, then tapping around the edges with a hammer. Bolt holes can be formed by tapping with the rounded end of a ball pein hammer. — D. McKenzie, Jordanville, Vic.

LEAK REPAIR

A QUICK, cheap and effective cure for a leaking fuel tank or line is to rub soap over the fracture. The soap should be moistened a little in water, then pressed hard over the leaking point. Petrol won't dissolve the soap—I know of a case where such repair was still holding after four months' country use.—D. Clark, Elizabeth South, S.A.

SUCTION WINDSCREEN WIPERS

THE cost of the effective yet simple valve described, for fitting a vacuum tank for a suction windscreen wiper, is negligible. It consists of an old bicycle-tube valve with all the fittings removed. A ball bearing (preferably unused) is dropped into the top to rest on the valve seating. The top corners above the slots are bent inwards sufficiently to prevent the ball being sucked out. A rubber connector for flexible gas piping forms the outer case and the copper suction tube from the carburettor just fits the top if about an inch of rubber suction tubing is fitted as packing. The "T" junction at the bottom is made by drilling and soldering copper pipe. From this, rubber suction tubing leads to the existing wiper connection and to the new vacuum tank to be fitted at any convenient place. The complete fitting needs to be approximately vertical, as shown in the sketch, so that the valve closes by gravity when there is no suction from the carburettor.—V. S. Kingley, Richmond, Vic.



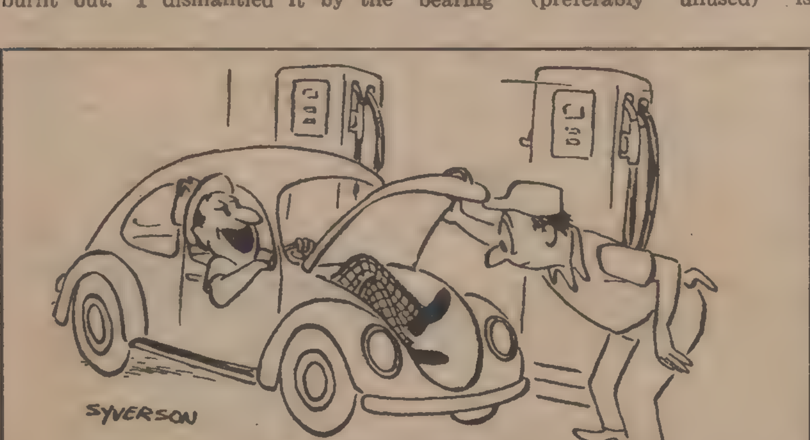
Use of a simple valve as a suction windscreen wiper.

> ONE guinea will be paid for each hint published. With these samples as a guide, jot down your own bright ideas and send them to P.M. and M.C.

AUTOMATIC REVERSING LIGHT

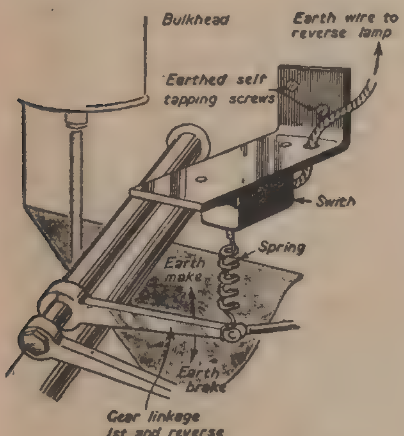
TO make and fit an automatic reversing light to a Zephyr Six recently I first obtained a door courtesy light switch for a few shillings and attached this to a strip of metal approximately 6in. x 2in. I then attached the unit by means of two self-tapping screws to the bulkhead above the gear linkage, after which I fitted a short light spring from the reverse and first gear linkage to the switch, thus rendering the earth contact void with the linkage in the neutral position and earth contact in the reverse position.

Now, by insulating the reversing



"The engine's in the rear."

"Any particular junkyard you want it towed to?"



Automatic reversing light for a Zephyr Six.

lamp earth contact and bringing an earth wire to the switch, the lamp lights when the reverse gear is engaged. — R. R. Hoare, Artarmon. N.S.W.

TAPPET CHECK AID

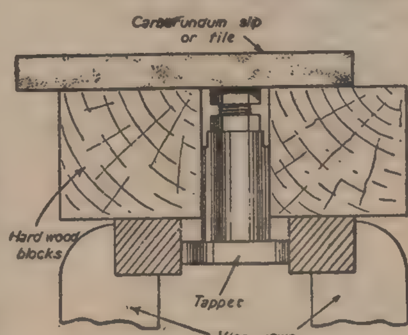
A SIMPLE tool for holding side-valve valve lifters from turning while tappets are being adjusted is made from a $\frac{1}{8}$in.-thick piece of scrap metal, shaped as shown in the sketch.

The metal should be about $1\frac{1}{2}$in. wide and $\frac{5}{8}$in. longer than the distance between the centres of two valve lifters. Cut two slots, one at each end, equal in width to the flats on the lifters. One slot should be about $\frac{3}{4}$in. deep, the other $1\frac{1}{2}$in. deep. The longer slot is slipped over the flats of the valve lifter, then the shorter one is fitted on to the adjacent one. This holds the lifters from turning and makes tappet adjustment much more simple —V. Eddy, Eastwood, N.S.W.

FACING TAPPETS

DURING a recent overhaul of my Fiat 500 engine I found the tappets to be deeply indented and requiring facing. Since all I had for the work was a carborundum slip stone the difficulty was to obtain a flat surface, square with the longitudinal axis of the tappet.

I solved the problem by drilling, in a block of hard wood, a hole which would receive the body of the tappet



Showing use of hardwood blocks when facing tappets.

with a reasonably tight fit. The face of the tappet stud was allowed to protrude by a fraction from the top face of the wood block, the latter acting as a guide for the carborundum slip. As the metal was removed from the tappet the latter was eased up in the block. The base of the tappet was secured in the vice as illustrated. — D. Hartley, Hamilton, Qld.

QUIETER BALL-JOINT

RATTLING ball-joint couplings for trailers and caravans can be made to give quiet service by using a bush-

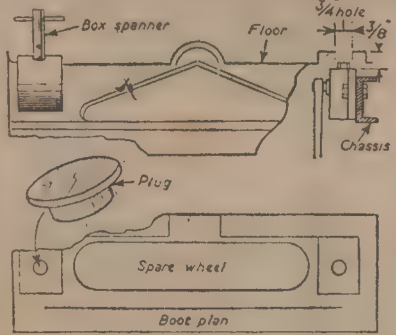
ing made of thin inner tube (from a bicycle or motor-cycle tube). This is fitted around the metal ball before clamping on the coupling. — H. Blenkin, Wingham, N.S.W.

HUB REMOVAL

A SPECIAL hub puller is the right tool for removing most late-model wheel hubs, but if one isn't available this method is worth trying. Remove the axle nut on the hub to be pulled, jack up the opposite side wheel, then, using a brass drift, give a few sharp blows against the hub to be removed. This usually frees the hub and allows it to be slid off easily.—H. Blenkin, Wingham, N.S.W.

TOPPING-UP SHOCK-ABSORBERS

ON my Wolseley 8 I have found it nearly impossible to top-up the rear shock-absorbers, owing to inaccessibility. I simply cut a ¾in. diameter hole in the boot floor, exactly over the filler nut, and with the aid of a

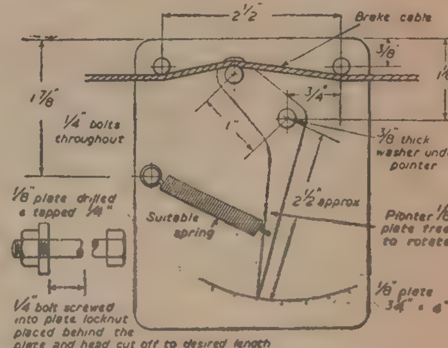


Topping-up shock absorbers.

box spanner completed the job in a matter of minutes. A plug was made of plywood to fit the hole.—A. Black. Artarmon, N.S.W.

BRAKE ADJUSTMENT

I FIND the small gadget illustrated most useful when brakes have become very unequal. It is suitable for most cable brakes, being very simple to operate. The brake adjusters in the wheels are adjusted until the wheels are locked. The



Simple arrangement for adjusting brakes.

handbrake is then pulled partly on (say, two notches) and the device is next placed on each cable in turn and the cables adjusted until the pointer shows a similar reading on each cable. The handbrake is then released and the brakes adjusted in the normal way.—C. G. Wiggin, Holland Park, Qld.

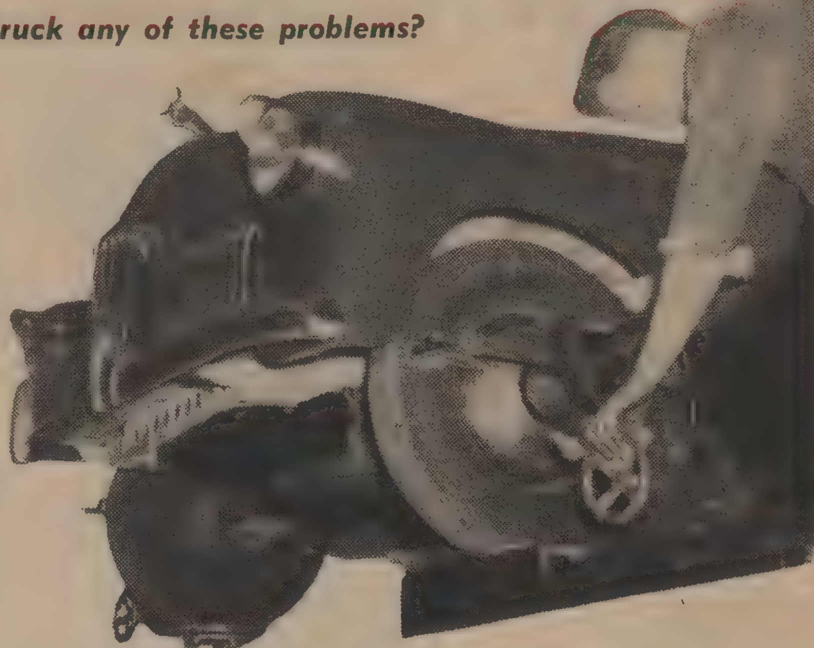
FILING WASHERS

FILING a washer to reduce its thickness is often an awkward job because the washer cannot be held easily in a vice. A useful dodge is to mount a 2in.-square block of wood in the vice, place the washer on the end of the grain and tap it lightly with a hammer. This embeds the washer sufficiently to hold it while its face is filed.—J. Allcott, Medindie, S.A.

". . . and the nice thing about it, Henry—I didn't lose the part—it's right here in plain sight!"

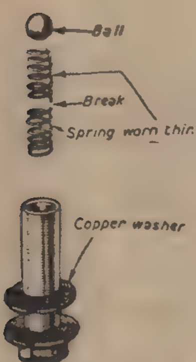
GARAGE MECHANIC'S DIARY

● *Have you struck any of these problems?*



ENGINE OVERHEATING

AN owner called at the garage to ask if we could "run the rule" over his engine. He was on a 300-mile journey and had covered the first 200 miles. Until about 160 miles had been covered the car had run excellently, but after that the engine suddenly began to show signs of overheating and of lacking its former "pep." He had stopped to check the level of the radiator water, but that was all right. Then he had had a



Sudden drop in oil pressure was found to have been caused by breakage of pressure - release valve spring.

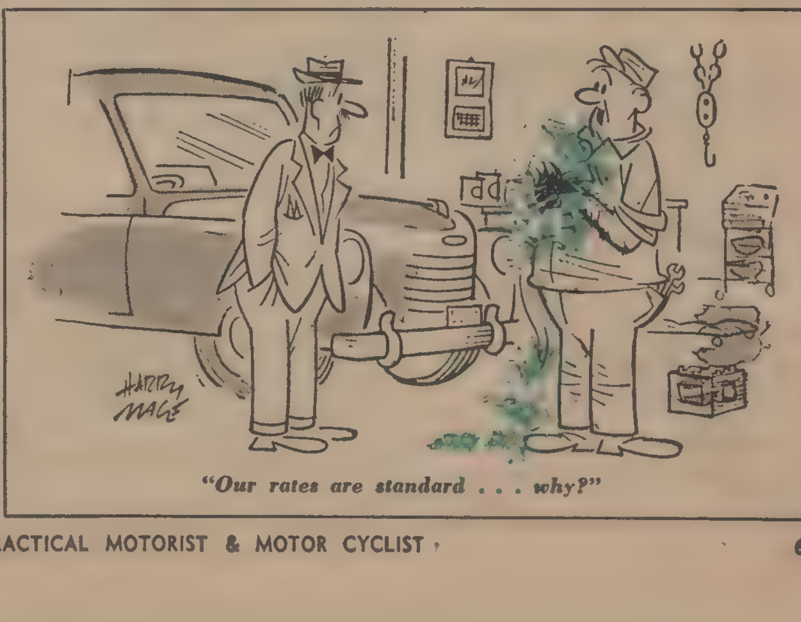
quart of oil—of slightly heavier grade than usual—put into the sump. On starting off again after these attentions the engine seemed to run better for a short time, and then the trouble started again.

Perhaps the radiator muff was not open sufficiently, even though the weather was very cold, or perhaps the fan was not working properly. He stopped and examined both of these items and actually removed the muff completely. There was again a slight improvement, but it was short-lived. It was at this point that our aid was solicited. There was no radiator thermostat, so it was unlikely that there was any stoppage in the cooling system. Signs of sticking valves or air leakage into the cylinders were absent, so we suggested accompanying the driver for a short run. It was at once noticed that the oil pressure was only about 20lb. per sq. in. when travelling at 40 m.p.h. in top gear. At higher speeds the pressure fell to about 10, whilst when the engine was running slowly the needle fell right back to zero.

FAULTY RELEASE VALVE

THIS was pointed out to the owner, but although he agreed that the pressure was lower than normal he put this down to having done 200 miles at a high average speed. Our view was that the pressure would normally have fallen to its lowest after 30 or 40 miles had been covered, for the engine would certainly have reached its maximum running temperature by that time. However, we decided to examine the pressure-release valve for the oil pump. In this case it was mounted just under the pump on the nearside of the engine. On removing the hexagon-headed plug (which was integral with a tube carrying the spring) it was found that the spring had actually broken in two. The ball was perfectly true, so it was no doubt able to seat properly. Apparently the spring had been rubbing lightly on the edge of the tube in which it was carried; this had worn the edges of the centre coils flat on the outside and eventually one coil had broken. This had the effect of shortening the effective length of the spring.

A new spring was not quickly available, so we found a short length of rod equal in diameter to the spring and cut it slightly shorter than the longer piece of the broken spring, put the shorter piece of spring in the tube and placed the rod over it. On reassembly the pressure had been returned to normal and the owner was able to proceed on his way. We advised him, of course, to obtain a new spring at the first opportunity.



"Our rates are standard . . . why?"

although the improvisation would ensure proper engine lubrication in the meantime.

TOP-GEAR FAULT

THE owner of a car bearing an excellent reputation found that top gear had suddenly developed the habit of slipping out of engagement. This fault did not apply to any other gears and was therefore very perplexing to the owner. Examination of the gearbox showed that the top-gear dogs were badly worn at the edges and appeared to be soft, and the owner was very surprised when we suggested that the car had been towed not long ago. He agreed that this was so, and said that last month he was involved in a collision and that the rear axle was damaged; the car was towed several miles to a garage for repairs to be carried out. Then we explained that it was probably during this time that the top-gear dogs had been overheated and softened, and that subsequent use had resulted in the damage now apparent. The damage could have been entirely avoided if top-gear had been engaged and the free-wheel control set to the "free" position.

This procedure should always be followed when towing a car having a free-wheel.

ERRATIC CLICKING FROM PETROL PUMP

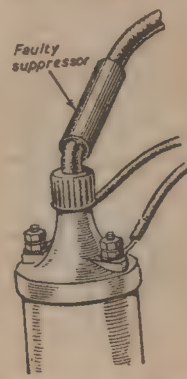
THE fact that there was an erratic and intermittent "click-clickety-click" noise from the electric petrol pump of his car, and that misfiring occurred at high engine speeds, led an owner to believe that the pump was defective and not supplying sufficient fuel to the carburettor. When the pump was checked by noting the flow from the pipe when it was held as high as possible above the pump, we considered that there was no shortage of petrol, despite the pump noise. This did not, however, prove that the pump was quite in order because it should not have made the noise complained of.

It led us to find that the carburettor filter was dirty—and responsible for the misfiring. As to the pump fault, we found that the contact points were rather dirty, although not badly worn. We cleaned them, after which the noise stopped. This experience shows how two minor faults occurring together can give the impression of something far more serious.

HARD STARTING

UNUSUALLY difficult starting and general lack of "pep" caused an owner to suspect almost everything except the real cause of the trouble. He first decarbonised and ground-in the valves despite the fact that there was very little accumulation of carbon. The carburettor was checked and returned, and the sparking plugs were removed, cleaned, re-set and tested. But the fault remained. The owner even tested thoroughly for air leaks into the induction system and sprayed the valve stems with upper-cylinder oil.

When we were asked to attend to the car we made a short trial run and drew the conclusion that the fault lay in the ignition. But it was soon found that the plugs, H.T. leads, contact-breaker and all connections were sound. And then it was noticed that there was a suppressor resistor in the main H.T. lead to the centre of the distributor (Fig. 2); the suppressor was, of course, to prevent electrical



Faulty suppressor in the main H.T. lead was a cause of hard starting.

interference with reception on the car radio. This resistor was removed and the H.T. lead taken direct to the distributor. That put an end to the troubles, proving that the resistor had developed a fault. When it was replaced by a new one it was found that the resistor did not have the slightest effect on engine performance.

This brings to mind a case where a suppressor condenser, wired between terminal Sw. on the coil and earth,

gave a good deal of trouble. In that case the engine was completely dead, and we did not find the condenser for some time, because it had been neatly tucked away. It had developed a short-circuit so that the primary winding of the coil, and also the contact breaker, became inoperative.

OILLESS BUSHES

As readers are no doubt aware, rubber bushes are so designed that they do not rotate bodily. Instead, the outside and inside faces are held fast, and all movement is due to the flexing of the rubber forming the walls of the tube. Sometimes the bush commences to slip round, and when that occurs there is usually a "grunting" noise.

Bushes of this type are often used for shock-absorber arms, and it is these which do sometimes give trouble. In most cases this starts or is most pronounced during wet weather, since any water which enters the bush acts as a lubricant. In the case of Silentbloc bushes replacement is usually desirable when this trouble arises (generally after a long mileage), but with some of the older types of simple rubber bush there is another method of repair. This consists of removing the nut which is used to mount the arm and taking off the large washer under it. A smaller washer, which fits inside the end of the eye in the arm, is then fitted. The other washer and nut are then replaced and the nut made tight. As a result of the smaller washer compressing the rubber the latter grips firmly on to the mounting pin.

SWAP SHOP

NEED a hard-to-get part for your car or cycle? Or have you some spares you'd like to pass on? Let us know and we'll publish a note in this section with your name and address so that interested readers can contact you direct.

1936 FORD V8 water temperature gauge wanted by Mr. K. Goods, Garup, Horsham, Victoria.

1928 BUICK STANDARD fibre timing cog wanted by Mr. A. J. de Rycke, Barongarook West, c/o Elliminyt P.O., via Colac, Victoria.

1936 INTERNATIONAL UTILITY SERIES C.1. cab only wanted by Mr. J. D. Martin, 6 Foch Avenue, West Coburg, Victoria.

MANUALS AND HANDBOOKS WANTED

Can anyone supply the following workshop manuals or instruction books? If so, please contact the undermentioned readers direct.

1937 Terraplane workshop manual wanted by Mr. R. J. Riley, 211 Venner Road, Fairfield, N.S.W.

1936 Buick 8/40 workshop manual wanted by Mr. D. R. Bron, 19 Prospect Street, Bowen Hills, Queensland.

Norton Single 500 c.c. 3½ h.p. instruction book wanted by Mr. A. Mason, c/o Mr. G. Hanam, M/S 26, Crows Nest, Queensland.

1938 Willys Sedan handbook wanted by Mr. S. R. Johnson, 27 Argyle Street, Auburn, N.S.W.

Our Experts Advise

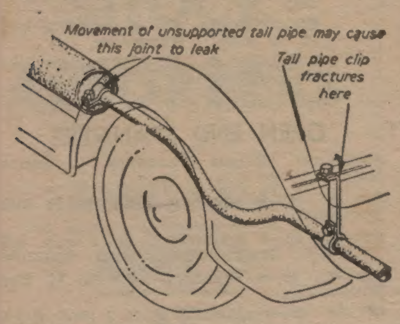
• Free service to P.M. readers

HAVE you a technical problem? Send your queries to Practical Motorist & Motor Cyclist, 19 Bridge Street, Sydney, with stamped addressed envelope for direct reply. Some typical problems are solved on this page.

EXHAUST PIPE LEAKS

MY car has a leak in the exhaust system, but I am not sure exactly where it is. The whole exhaust is badly rusted and small holes will not be easy to locate. Can you suggest the most likely places for leaks?—(V. Venables, Bundaberg, Qld.)

● Unless some physical damage, such as that caused by hitting a bump in the road, has been done to the muffler, normal wear usually takes place at the back end due to the tail pipe clip fracturing. The illustration shows the reasons for this. The inlet end of the muffler may also suffer.



Likely cause and location of leak in exhaust pipe.

BIG-END WEAR

I NOTICE a small amount of metal in the engine oil of my 1955 Matchless 350 c.c. motor-cycle, and there is a rapid tapping on decelerating, which may be tappet noise but which I cannot isolate. As the motor-cycle has only covered 10,000 miles, and has not been driven hard, I think it improbable that there is much big-end wear, but would like to be certain. —(M. F. Peters, Parramatta, N.S.W.)

As your 1955 G3LS Matchless has only covered 10,000 miles, it is unlikely that there would be any significant wear in the big-end. Much big-end wear, when it occurs, causes a knock and considerable noise. There is no means of checking big-end wear without removing the cylinder; if this is done, however, any play can be detected as vertical movement in the connecting rod when the crank is placed at bottom dead centre.

A very small amount of metal in the engine oil could probably be ignored, but much depends upon the amount and appearance of this. It might be well to have the engine taken down and examined. Failing this, it is suggested that you thoroughly drain and flush out the engine and oil tank to remove any remaining traces of metal. After refilling with oil, run the machine for one or two weeks, and then again drain the sump and very carefully examine the oil for more traces of metal. Should any be found, it would be unwise to run the engine further without examination.

SEIZED MOTOR

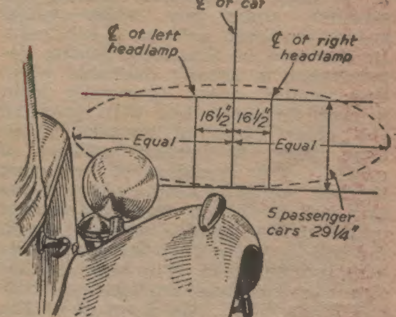
I OWN a 1937-8 model Austin. About six months ago the motor seized. Fortunately, I was able to free the motor at the time with penetrating oil. Some time later I inadvertently drove the car without oil and it seized again. I used penetrating oil in the hope of freeing the motor again, but this time without success. Could you tell me the best way to free the engine, the best point to apply the penetrating oil and some way (apart from drilling) to remove a broken stud in the sump?—(F. J. Hegarty, Willoughby, N.S.W.)

● It appears that you have seized your motor to an extent where it can be "freed up" only by dismantling. You may need to have it rebored. However, until it is dismantled you will not be able to assess what damage has been done. If the broken stud can't be gripped with a pair of multi-grips or with some other suitable tool, we see no alternative but to drill out the stud, leaving a shell only and then take out the residue with an Ezy-out extractor.

ALIGNING FORD HEADLA PS

THE headlamps of my pre-war Ford V-8 are slightly out of alignment, causing dazzle to other road users. Can you tell me how to realign them without having to make a series of trial-and-error experiments?—(F. E. Hill, Collingwood, Vic.)

● Stand the car on a level surface 25 feet from a wall. A line should be drawn on the wall parallel to and 29¼ inches from the ground. Draw another line vertical to this in line with the centre line of the car, and from this mark two more lines each 16½ inches from the centre-line. These will mark the centre-lines of the headlamps. Now switch the lights on (in their raised position) and, by loosening the nuts at the bottom of the brackets, adjust the headlamps so that the tops of the bright spots are at the horizontal line. When this has been done the bright spots of both headlamps should extend an equal amount beyond the marked centre-line of the car. Individual adjustment of each lamp is so that the bright spot spreads equally beyond the centre-line of the particular lamp.



Lining up Ford V-8 headlamps using wall as screen.

OIL TROUBLE

I OWN an o.h.v. B.S.A. C11 motor-cycle which has a very annoying fault. As you know, in the rocker box cover there are two screws, in each of which are two small holes. Once the engine is warm, oil vapor is forced from these holes in such a quantity that after a short time the engine is completely covered in oil. Needless to say, the carby, generator and trouser legs also suffer. Apart from the resultant mess, over a long trip I lose a lot of oil this way. I have checked the breather valve in the crankcase and it appears to be O.K. I have not seen any similar models with this complaint, so could you tell me how to cure it on my machine? — (L. Ireland, Bexley, N.S.W.)

● This problem has come to our notice once or twice before and in every case it has proved to be excessive crankcase pressure. Although you state that your crankcase breather valve appears to be functioning correctly we are reasonably sure that if you remove the valve and clean it thoroughly your crankcase will not give you any further trouble.

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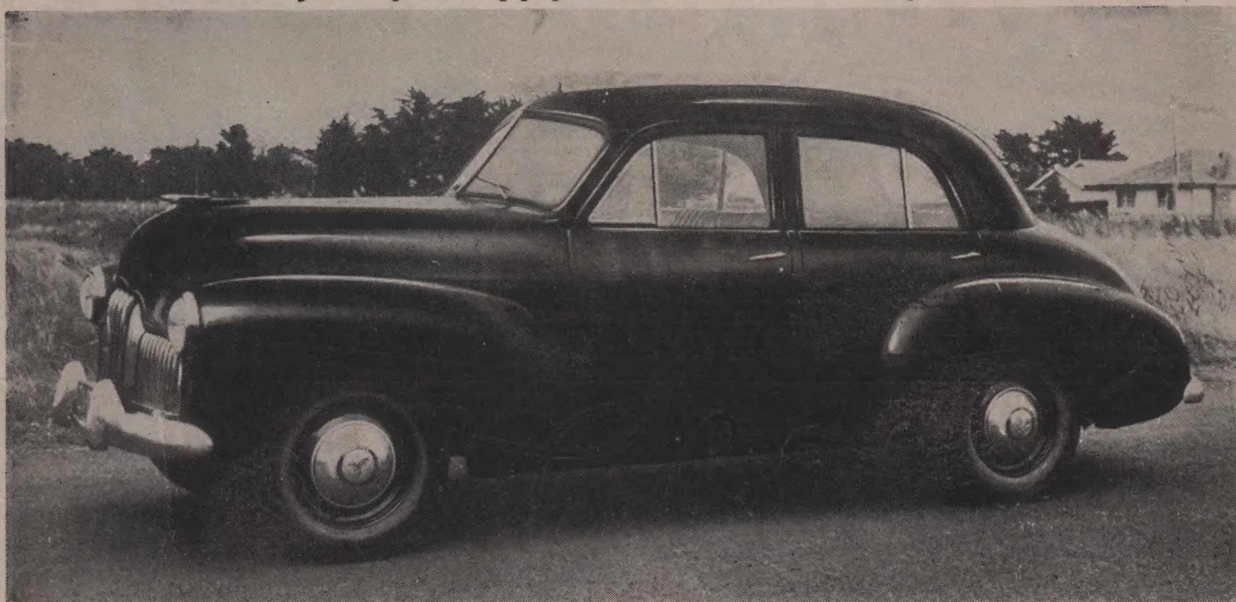

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